Transport Canada Transports Canada

Department of Transport

Supplemental Type Certificate

This approval is issued to:

Aero Design Ltd.
2013 39th Avenue North East
Calgary, Alberta
Canada T2E 6R7

Number: SH05-17
Issue No.: 2
Approval Date: April 14, 2005
Issue Date: April 19, 2006

Responsible Office: Prairie and Northern

Aircraft/Engine Type or Model: ROBINSON R22, R22 ALPHA, R22 BETA, R22 MARINER, R44, R44 II

Canadian Type Certificate or Equivalent: ROBINSON R44, R44 II H-97
ROBINSON R22, R22 ALPHA, R22 BETA, R22 MARINER H10WE

Description of Type Design Change: BEAR PAWS INSTALLATION

Installation/Operating Data, Required Equipment and Limitations:

Bear Paws Installation on Robinson R44 Series to be in accordance with Transport Canada approved *AERO* Design Ltd. Document Control List DCL640, Rev 0, dated April 12, 2005. Instructions for Continued Airworthiness contained in *AERO* Design Ltd. document ICA640.90, Rev 0 or later applicable revision are required with this installation.

Bear Paws Installation on Robinson R22 Series to be in accordance with Transport Canada approved *AERO* Design Ltd. Document Control List DCL640-2, Rev 0, dated February 23, 2006. Instructions for Continued Airworthiness contained in *AERO* Design Ltd. document ICA640.91, Rev 0 or later applicable revision are required with this installation.

– End –

DEPARTMENT OF TRANSPORT CANADA MINISTÈRE DES TRANSPORTS

Conditions: This approval is only applicable to the type/model of aeronautical product specified therein. Prior to incorporating this modification, the installer shall establish that the interrelationship between this change and any other modification(s) incorporated will not adversely affect the airworthiness of the modified product.

Greg Oucharek
For Minister of Transport

Canada

DOCUMENT CONTROL LIST

DOCUMENT NO.	DOCUMENT CONTENT	REVISION
INSTALLATION DOCUMENTS		
64001	Bear Paws Installation	1
ICA640.90	Instructions for Continued Airworthiness	0
FABRICATION DOCUMENTS		
64010	Paw Assembly	1
64020, Sheet 1	Paw Fabrication	1
64020, Sheet 2	Paw Fabrication	1
64021	Parts Fabrication	0
ENGINEERING DOCUMENTS		
ER640.01	Engineering Report	0
FTP640.02	Flight Test Plan	1

APPROVAL:

Transport Canada / Transports Canada
AIRCRAFT CERTIFICATION DIVISION
APPROVED
By
Appr'l No. SH05-17
Appr'l Date 2005-04-14
Issue No. 2
Issue Date 2006-04-19
YY - MM - DD

ORIGINAL DATE:
12 April, 2005
REVISION DATE:
23 February, 2006

AERO DESIGN LTD.
2013 – 39th Ave NE
Calgary, Alberta
T2E 6R7
Ph. (403) 250-8027
Fax. (403) 250-8333

SHEET 1 OF 1

Robinson R44, R44 II
Bear Paws Installation

DCL640

Rev. 1

DOCUMENT CONTROL LIST

DOCUMENT NO.	DOCUMENT CONTENT	REVISION
INSTALLATION DOCUMENTS		
64002	Bear Paws Installation	0
ICA640.91	Instructions for Continued Airworthiness	0
FABRICATION DOCUMENTS		
64011	Paw Assembly	0
64025, Sheet 1	Paw Fabrication	0
64025, Sheet 2	Paw Fabrication	0
64026	Parts Fabrication	0
ENGINEERING DOCUMENTS		
ER640.02	Engineering Report	0
FTP640.03	Flight Test Plan	2

APPROVAL:

Transport Canada / Transports Canada
AIRCRAFT CERTIFICATION DIVISION
APPROVED
By
Appr'l No. SH05-17
Appr'l Date 2005-04-14
Issue No. 2
Issue Date 2006-04-19
YY - MM - DD

ORIGINAL DATE:
23 February, 2006
REVISION DATE:

AERO DESIGN LTD.
2013 – 39th Ave NE
Calgary, Alberta
T2E 6R7
Ph. (403) 250-8027
Fax. (403) 250-8333

SHEET 1 OF 1

Robinson R22
Bear Paws Installation

DCL640-2

Rev. **0**

APPLICANT: AERO Design Ltd.
2013 - 39th Ave N.E.
Calgary, Alberta, T2E 6R7

CORRESPONDANCE TO: AERO Design Ltd.
(If other than applicant) 2013 - 39th Ave N.E.
Calgary, Alberta, T2E 6R7

DATE: 04 February, 2005
REV. No. 3 30 January, 2006

MAKE: Robinson
MODEL: R44 all series, R22 all series

REGISTRATION: All eligible
SERIAL No.: All eligible

NATURE OF WORK: Bear Paws Installation

MODEL CERTIFICATION BASIS: FAR 27, 1 February, 1965, including amendments 27-1 thru 27-24 (R44)
MODIFICATION CERTIFICATION BASIS: FAR 27, 1 February, 1965, including amendments 27-1 thru 27-24

Airworthiness Requirement	Subject for Compliance or Documentary Proof	Form of Substantiation	DOT	DAR	Comments
Subpart B	**Flight**				
27.51(a)(1)	Takeoff	Flight test	X		
27.65	Climb: All Engines Operating	Flight test	X		
27.75(a)(1)	Landing	Flight test	X		
27.141	General	Flight test	X		
27.143	Controllability and maneuverability	Flight test	X		Flight Test iaw TR640.02 (R44)
27.171	Stability: General	Flight test	X		Flight Test iaw TR640.03 (R22)
27.173	Static Longitudinal Stability	Flight test	X		
27.175	Demonstration of Static Long. Stability	Flight test	X		Flight test witness will be done by DAR 290M
27.177	Static Directional Stability	Flight test	X		
27.231	General	Flight Test	X		
27.251	Vibration	Flight test	X		
Subpart C	**Strength Requirements**				
27.301	Loads	Analysis		X	
27.303	Factor of Safety	Analysis		X	
27.305	Strength and Deformation	Analysis		X	
27.307	Proof of Structure	Analysis		X	
27.309	Design Limitations	Flight test NO CHANGE	X		Flight Test iaw TR640.02 / TR640.03
Subpart D	**Design and Construction**				
27.601	Design	Design		X	
27.603	Materials	Specification on drawings		X	
27.607	Fasteners	Specification on drawings		X	
27.629	Flutter	Flight Test		X	Flight Test iaw TR640.02 / TR640.03
27.773(a)(2)	Pilot Compartment View - Reflections	Specification on drawings		X	Part to be painted matte black

Airworthiness Requirement	Subject for Compliance or Documentary Proof	Form of Substantiation	DOT	DAR	Comments
Subpart G	**Operating Limitations and Information**				
27.1505	Never-Exceed Speed	Flight Test	X		Flight Test iaw TR640.02 / TR640.03
27.1529	Instructions for Continued Airworthiness	ICA provided	X		

APPENDIX A

SUPPLEMENTAL ICA COMPLIANCE CHECK SHEET

FOR NORMAL CATEGORY ROTORCRAFT

BLOCK 1

Name of the applicant for the design change approval: AERO Design Ltd.

Description of the design change: Installation of Bear Paws on Robinson R22

Certification Basis of design change and revision date: FAR 27 at amendment 27-24

Program showing how changes to supplemental ICA will be distributed (FAR A27.1(c)): Section 5-17 of Supplemental ICA

BLOCK 2

Column 1	Column 2	Column 3
A27.2 (a) (Manual(s))	ICA ref: Robinson R22 Maintenance Manual, Section 5	Supplemental ICA ref: Single Manual (ICA640.90)
A27.2(b) (Practical arrangement)	ICA ref: Robinson R22 Maintenance Manual, Section 5	Supplemental ICA ref: Arranged in ATA format
A27.3 (a) (1) (Introduction)	ICA ref: Robinson R22 Maintenance Manual, Section 5	Supplemental ICA ref: Section 5-1
A27.3 (a) (2) (Description)	ICA ref: Robinson R22 Maintenance Manual, Section 5	Supplemental ICA ref: Section 5-4
A27.3 (a) (3) (Control & Operation)	ICA ref: N/A	Supplemental ICA ref: N/A (Section 5-5)
A27.3 (a) (4) (Servicing)	ICA ref: Robinson R22 Maintenance Manual, Section 5	Supplemental ICA ref: Section 5-6
A27.3 (b) (1) (Scheduling)	ICA ref: Robinson R22 Maintenance Manual, Section 5	Supplemental ICA ref: Section 5-7
A27.3 (b) (2) (Troubleshooting)	ICA ref: N/A	Supplemental ICA ref: N/A (Section 5-8)
A27.3 (b) (3) (Removal/replacement)	ICA ref: Robinson R22 Maintenance Manual, Section 5	Supplemental ICA ref: Section 5-9
A27.3 (b) (4) (General)	ICA ref: N/A	Supplemental ICA ref: N/A
A27.3 (c) (Access)	ICA ref: N/A	Supplemental ICA ref: N/A (Section 5-11)
A27.3 (d) (Special inspections)	ICA ref: Robinson R22 Maintenance Manual, Section 5	Supplemental ICA ref: Section 5-12
A27.3 (e) (Protective treatment)	ICA ref: Robinson R22 Maintenance Manual, Section 5	Supplemental ICA ref: Section 5-13
A27.3 (f) (Fasteners, torque values, etc)	ICA ref: Robinson R22 Maintenance Manual, Section 5	Supplemental ICA ref: Section 5-14
A27.3 (g) (Special tools)	ICA ref: N/A	Supplemental ICA ref: N/A (Section 5-15)

A27.4 (a) (AWL - Separate Section[1])	ICA ref: Robinson R22 Maintenance Manual, Section 5	Supplemental ICA ref: Section 5-16
A27.4 (a) 1 (Structures)	ICA ref: N/A	Supplemental ICA ref: N/A
A27.4 (a) 2 (Fuel Tank System)	ICA ref: N/A	Supplemental ICA ref: N/A
A27.4 (b) (Principal Manual)	ICA ref: N/A	Supplemental ICA ref: N/A

[1] Airworthiness Limitations differ from other maintenance tasks, in that they are mandatory, as a direct condition of the approval of the type design. They are therefore referenced directly in the approval document itself. However, they must also be included in the Supplemental Instructions for Continued Airworthiness.

BLOCK 3

The change in type design is adequately supported by existing ICA and/or supplemental ICA, as identified above.

Signature: _____ Date: 2006-04-19 Design Approval Number SH05-17

NOTE ICA TYPICAL TO ICA64890 APPROVED @ ISSUE 1.

Transport Canada | Transports Canada

Prairie and Northern Region - Aircraft Certification - RACD
800-1601 Airport Rd NE
Calgary, Alberta
T2E 6Z8

Your File | Votre référence

Our file | Notre référence

C-05-00255

April 12, 2005

AERO Design Ltd.
2013-39 Ave. N.E.
Calgary AB
T2E 6R7

Subject: **STC Approval of Bear Paws Installation, Robinson R44 / R44 II, Approval No. SH05-17 Issue 1**

Mr. Burgoin,

This Supplemental Type Certificate (STC) is issued in response to your application submitted February 2, 2005 for the subject Design Change.

The transfer of these documents in the name of another person requires a prior approval from the Minister in accordance with Canadian Aviation Regulations (CAR) 513.25.

In accordance with CAR Part V, Subpart 61, a Manufacturing Approval is required for the manufacture of parts or kits which are to be installed by an individual or organization other than the manufacturer. Consult Information Note (ii) following Airworthiness Manual 561.01 (2) for additional guidance.

An STC holder is required to report any service problem experienced with their product. Therefore, should you become aware of any defect, malfunction, or failure resulting from the design change, it is your responsibility to submit a Service Difficulty Report to Transport Canada in accordance with CAR Part V, Subpart 91

Thank you,

Greg Oucharek, P. Eng
Senior Engineer, Aircraft Certification
(403) 292-4990
oucharg@tc.gc.ca

Canada

Transport Canada Transports Canada

Department of Transport

Supplemental Type Certificate

This approval is issued to:

Aero Design Ltd.
2013 - 39 Avenue, N.E.
Calgary, Alberta
Canada T2E 6R7

Number: SH05-17
Issue No.: 1
Approval Date: April 14, 2005
Issue Date: April 14, 2005

Responsible Office: Prairie and Northern
Aircraft/Engine Type or Model: ROBINSON R44, R44 II
Canadian Type Certificate or Equivalent: ROBINSON R44, R44 II H-97
Description of Type Design Change: BEAR PAWS INSTALLATION

Installation/Operating Data, Required Equipment and Limitations:

Bear Paws Installation to be in accordance with Transport Canada approved *AERO* Design Ltd. Document Control List DCL640, Rev 0, dated April 12, 2005.

Instructions for Continued Airworthiness contained in *AERO* Design Ltd. document ICA640.90, Rev 0 or later applicable revision are required with this installation.

– End –

Conditions: This approval is only applicable to the type/model of aeronautical product specified therein. Prior to incorporating this modification, the installer shall establish that the interrelationship between this change and any other modification(s) incorporated will not adversely affect the airworthiness of the modified product.

Greg Oucharek
For Minister of Transport

Canada

TRANSFER ENDORSEMENT

A transfer of ownership requires prior approval from the Minister.

The reissue of the certificate in the name of the transferee will be contingent upon a demonstration made by the new owner that he/she can fulfill the responsibilities of the holder as described in Airworthiness Manual Chapter 513.

TRANSFER OF OWNERSHIP

TO (NAME AND ADDRESS OF TRANSFEREE) _____

_____

_____

_____

FROM (NAME AND ADDRESS OF OWNER) _____

_____

_____

_____

TRANSFER PARTICULARS (LICENSE AGREEMENT, SALE OF RIGHTS, ETC.) _____

_____

_____

_____

DATE OF TRANSFER _____

_____

SIGNATURE (OF TRANSFERRING OWNER)

DOCUMENT CONTROL LIST

DOCUMENT NO.	DOCUMENT CONTENT	REVISION
INSTALLATION DOCUMENTS		
64001	Bear Paws Installation	0
ICA640.90	Instructions for Continued Airworthiness	0
FABRICATION DOCUMENTS		
64010	Paw Assembly	0
64020, Sheet 1	Paw Fabrication	0
64020, Sheet 2	Paw Fabrication	0
64021	Parts Fabrication	0
ENGINEERING DOCUMENTS		
ER640.01	Engineering Report	0
FTP640.02	Flight Test Plan	1

APPROVAL:

ORIGINAL DATE:

12 April, 2005

REVISION DATE:

AERO DESIGN LTD.
2013 – 39th Ave NE
Calgary, Alberta
T2E 6R7
Ph. (403) 250-8027
Fax. (403) 250-8333

SHEET 1 OF 1

Robinson R44, R44 II
Bear Paws Installation

DCL640

Rev.

0

AERO Design Ltd.

AIRWORTHINESS REQUIREMENTS COMPLIANCE PROGRAM

APPLICANT: AERO Design Ltd.
2013 - 39th Ave N.E.
Calgary, Alberta, T2E 6R7

DATE: 04 February, 2005
REV. No. 1 04 April, 2005

MAKE: Robinson
MODEL: R44

CORRESPONDANCE TO: AERO Design Ltd.
(If other than applicant) 2013 - 39th Ave N.E.
Calgary, Alberta, T2E 6R7

REGISTRATION: All eligible
SERIAL No.: All eligible

NATURE OF WORK: Bear Paws Installation

MODEL CERTIFICATION BASIS: FAR 27, 1 February, 1965, including amendments 27-1 thru 27-24
MODIFICATION CERTIFICATION BASIS: FAR 27, 1 February, 1965, including amendments 27-1 thru 27-24

Airworthiness Requirement	Subject for Compliance or Documentary Proof	Form of Substantiation	DOT	DAR	Comments
Subpart B	**Flight**				
27.51(a)(1)	Takeoff	Flight test	X		
27.65	Climb: All Engines Operating	Flight test	X		
27.75(a)(1)	Landing	Flight test	X		
27.141	General	Flight test	X		
27.143	Controllability and maneuverability	Flight test	X		Flight Test in accordance with TR640.02
27.171	Stability: General	Flight test	X		
27.173	Static Longitudinal Stability	Flight test	X		Flight test witness will be done by DAR 290M
27.175	Demonstration of Static Long. Stability	Flight test	X		
27.177	Static Directional Stability	Flight test	X		
27.231	General	Flight Test	X		
27.251	Vibration	Flight test	X		
Subpart C	**Strength Requirements**				
27.301	Loads	Analysis		X	
27.303	Factor of Safety	Analysis		X	
27.305	Strength and Deformation	Analysis		X	
27.307	Proof of Structure	Analysis		X	
27.309	Design Limitations	Flight test		X	Flight Test in accordance with TR640.02
Subpart D	**Design and Construction**				
27.601	Design	Design		X	
27.603	Materials	Specification on drawings		X	
27.607	Fasteners	Specification on drawings		X	
27.629	Flutter	Flight Test		X	Flight Test in accordance with TR640.02
27.773(a)(2)	Pilot Compartment View - Reflections	Specification on drawings		X	Part to be painted matte black

Airworthiness Requirement	Subject for Compliance or Documentary Proof	Form of Substantiation	DOT	DAR	Comments
Subpart G	**Operating Limitations and Information**				
27.1505	Never-Exceed Speed	Flight Test	X	X	Flight Test in accordance with TR640.02
27.1529	Instructions for Continued Airworthiness	ICA provided			

Transport Canada

Transports Canada

Prairie and Northern Region - Aircraft Certification - RACD
800-1601 Airport Rd NE
Calgary, Alberta
T2E 6Z8

Your File Votre référence

Our file Notre référence

C-06-0084

April 19, 2006

AERO Design Ltd.
2013-39 Ave. N.E.
Calgary AB
T2E 6R7

Subject: **STC Approval of Bear Paws Installation, Robinson R44 and R22 Series, Approval No. SH05-17 Issue 2**

Mr. Burgoin,

This Supplemental Type Certificate (STC) is issued in response to your application submitted January 23, 2006 for the subject Design Change.

The transfer of these documents in the name of another person requires a prior approval from the Minister in accordance with Canadian Aviation Regulations (CAR) 513.25.

In accordance with CAR Part V, Subpart 61, a Manufacturing Approval is required for the manufacture of parts or kits which are to be installed by an individual or organization other than the manufacturer. Consult Information Note (ii) following Airworthiness Manual 561.01 (2) for additional guidance.

An STC holder is required to report any service problem experienced with their product. Therefore, should you become aware of any defect, malfunction, or failure resulting from the design change, it is your responsibility to submit a Service Difficulty Report to Transport Canada in accordance with CAR Part V, Subpart 91

Thank you,

Greg Oucharek, P. Eng
Senior Engineer, Aircraft Certification
(403) 292-4990
oucharg@tc.gc.ca

Canada

SENDER RETAIN THIS COPY / COPIE DE L'EXPÉDITEUR

SENDER ACCOUNT NO. / N° DE COMPTE DE L'EXPÉDITEUR: 4367155

IMPORTANT - TELEPHONE: (403) 250 8027

SENDER (FROM) / EXPÉDITEUR (DE): AERO DESIGN

MO DY JR YR/AN: 02 15 06

STREET ADDRESS / ADRESSE NUMÉRIQUE: 2013 39TH AVE N.E. #2013

APT. SUITE / APP. BUREAU:

CITY / VILLE: CALGARY

PROV. STATE / ÉTAT: ALTA

POSTAL / ZIP: T2E 6R7

RECEIVER / DESTINATAIRE: E+B HELICOPTERS

STREET ADDRESS / ADRESSE NUMÉRIQUE: 2595 ISLAND HWY

APT. SUITE / APP. BUREAU:

CITY / VILLE: CAMPBELL RIVER

PROV. STATE / ÉTAT: BC

POSTAL / ZIP: V9W 2H2

ATTN. NAME / NOM À L'ATTENTION DE / NOM SERVICE: ED WILCOCK

IMPORTANT - TELEPHONE: (250)2874421

DESCRIPTION OF GOODS / DESCRIPTION DES MARCHANDISES: DOCUMENTS

DG / MD:

SENDER REFERENCE / AUTRE RÉF. DE L'EXPÉD.:

PICK UP / CUEILLETTE - N° DE CONF.: 0001

SIGNATURE DE L'EXPÉDITEUR: Jeff Clark

SELECTIONS OF CARRIER'S CONDITIONS OF TRANSPORT / SÉLECTIONS DES CONDITIONS DE TRANSPORT DU TRANSPORTEUR

SHIP MODE / MODE DE TRANSPORT

AIR / AÉRIEN: X

GROUND / ROUTIER:

PKG / EMBAL. (TYPE ONLY / TYPE SEULEMENT)

PURO-LETTER: X

PURO-PAK:

OTHER / AUTRE:

SERVICE (PIECE ONLY / PIÈCE SEULEMENT)

9 AM 9h:

10:30AM 10h30:

SAT. SAM.:

PAYMENT / PAIEMENT

CASH / COMPTANT:

CREDIT CARD / CARTE DE CRÉDIT:

RECEIVER OR THIRD PARTY ACCOUNT NO. / N° DE COMPTE DU DESTINATAIRE OU TIERS

RECEIVER / DESTINATAIRE:

3RD PARTY / TIERS:

CHARGES / FRAIS

TOTAL AMOUNT / MONTANT TOTA

SENDER / EXPÉDITEUR: X

SHIPMENT / DÉTAILS / EXPÉDITION

#/Nbre PCS (4 MAXIMUM)	WEIGHT / POIDS SUBJ TO CORR / SUJET A CORR	
	KG	LB
1		1

DECLARED VALUE / VALEUR DÉCLARÉE

$

$5 000 MAX MAX 5 000 $

THIRD PARTY BILLING NAME & ADDRESS / FACTURATION À UN TIERS, NOM ET ADRESSE

BILL OF LADING NO / NOT NEGOTIABLE / N° DE CONNAISSEMENT / NON NÉGOCIABLE: 2241 630 7050

Purolator

1 888 SHIP-123 www.purolator.com

COURIER INITIALS / INITIALES DU COURRIER: 6

COURIER ROUTE / ITINÉRAIRE DU COURRIER: 265

MO DY JR YR/AN: 215

NO / N°:

TYPE: VISA MC AMEX

EXP. DATE / D'EXP.:

LIMITATION OF LIABILITY. IMPORTANT - PLEASE READ. LIMITATION DE RESPONSABILITÉ. IMPORTANT - LISEZ S.V.P.

THE AMOUNT OF ANY LOSS OR DAMAGE FOR WHICH THE / LE MONTANT DE TOUTE PERTE OU DOMMAGE DONT LE

AND EXCLUSIONS OF CARRIER'S LIABILITY, WHICH ARE / LIMITATIONS ET EXCLUSIONS DE RESPONSABILITÉ DU

PLEASE REFER TO BILL OF LADING NUMBER FOR SHIPMENT STATUS / INQUIRIES. POUR TOUT RENSEIGNEMENT, VEUILLEZ NOUS COMMUNIQUER LE NUMÉRO DE CONNAISSEMENT.

SENDER RETAIN THIS COPY / COPIE DE L'EXPÉDITEUR

Jeff Clarke

From: Oucharek, Gregory [OUCHARG@tc.gc.ca]
Sent: Wednesday, April 19, 2006 8:56 AM
To: jeff@aerodesign.ca
Subject: RE: R44/R22 Bear Paws

Thanks Jeff ... actually the drawing first questioned were related to the Mirror Instl ... 64921.

I did also notice the Bear Paw notes this morning.

One more DCN for 64921 will close that file off. The certificate was issued yesterday and can be picked up if you like ... or wait until later today and I should also have the revision completed for the Bear Paw.

Cheers,

Greg

> -----Original Message-----
> **From:** Jeff Clarke [mailto:jeff@aerodesign.ca]
> **Sent:** Wednesday, April 19, 2006 8:49 AM
> **To:** Oucharek, Gregory
> **Subject:** R44/R22 Bear Paws
>
> Greg,
>
> Please find attached the drawing change notices for 64010 and 64011 to add the reference to Aero Design Standard Procedure 3001 for surface preparation and painting of aluminum as discussed.
>
> Thanks.
>
> Jeff

AERO DESIGN LTD.
2013 – 39th Ave N. E., Calgary, Alberta, T2E 6R7 aerodesign@telusplanet.net

F A X C O V E R S H E E T

DATE: 21 APR 2006 TIME: 3:48
TO: CHERYL PHONE:
E&B ITEZ1 FAX: (250) 287-4352

FROM: S. Fahey PHONE: 403-250-8027
Aero Design Ltd. FAX: 403-250-8333

Number of pages including cover sheet: 4

RE: APPROVAL DOCUMENTS FOR BEAR PAWS

AS REQUESTED.

STEVE

CHERYL E&B

BEAR PAWS
R44 ✓ STC, DCL
R22 ??

(250) 287-4352

AERO DESIGN LTD.
2013 – 39 Avenue N.E., Calgary, Alberta, T2E 6R7

Tel: 403-250-8027
Fax: 403-250-8333
aerodesign@telusplanet.net

19 April, 2006

E&B Helicopters Ltd.
PO Box 1000
Campbell River, BC
V9W 6Y4

Attn: Ed Wilcock

Re: R22/R44 Bearpaws

Received the latest revision of the approval with the R22 this afternoon. Please find attached a complete documentation package for each of the sets of bear paws sent by Greyhound:

R44 – 2 Sets of each		
Supplemental Type Certificate	SH05-17	Issue 2
Document Control List	DCL640	Revision 1
Instructions for Continued Airworthiness	ICA640.90	Revision 0
Installation Drawing	64001	Revision 1
Release Tag		

R22 – 2 Sets of each		
Supplemental Type Certificate	SH05-17	Issue 2
Document Control List	DCL640-2	Revision 0
Instructions for Continued Airworthiness	ICA640.91	Revision 0
Installation Drawing	64002	Revision 0
Release Tag		

Regards,

E. Burgoin, P.Eng, DAR 290M

Encl.

GREYHOUND CDA TRANS ORP

GST NO.891046655RT1 WAYBILL NO. 7322(5

CAMPBELL RIV BC

CALGAR 220 142458
04/19/ AM 26
ACTUAL 3.0 LBS
DECLAR 100.00

COLLECT

CONSIGNEE

REF: 1

E + B HELICOPTERS

EXPR 28.11
FUEL 1.34
GSTR 2.06

CAMPBELL RIV BC 250-287-4421

SHIPPER

AERO DESIGN

CALGARY AB 403-250-8027

REFERENCE:

TOTA 31.51

STATION TO STATION

FORM 256 REV 81/10/01

SHIPPER RECEIPT

GREYHOUND CDA TRANS CORP

GST NO 891646655RT1 WAYBILL NO. 732 [illegible] 9242

CAMPBELL RIV BC

CALG [illegible] IN 220 121929
06/0 [illegible] 04 AM 9
ACTUAL WEIGHT 16.0 LBS
DECL [illegible] UE NOV

COLLECT

CONSIGNEE

REF: 1

E&B HELICOPTRS

[illegible] 41.82
[illegible] 1.74

CAMPBELL RIV BC 250-287-4421

SHIPPER

AERO [illegible]

CALGARY AB 250-8027

REFERENCE: TO [illegible]

STATION TO STATION

SHIPPER'S RECEIPT

LIABILITY FOR LOSS, DAMAGE OR [illegible] AS LIMITED BY [illegible] UNLESS A GREATER AMOUNT IS DECLARED AND PAID FOR COST OF [illegible] CONSIDERED [illegible] TERMS AND CONDITIONS OF CARRIAGE FOR DETAILS OR CONSULT [illegible] SHIPPING.

GREYHOUND CDA TRANS CORP

GST NO.891646655RT1 WAYBILL NO. 73220516946

LIABILITY LIMITED TO $50 FOR LOSS OR DAMAGE HOWSOEVER OCCASIONED UNLESS A GREATER VALUE DECLARED AT TIME OF SHIPPING. REFER TO TERMS AND CONDITIONS OF CARRIAGE FOR DETAILS OR CONSULT AGENT.

CAMPBELL RIV BC

COLLECT

CALGARY NORTH 220 166126
03/19/07 4:57 PM 10
ACTUAL WEIGHT 14.0 LBS
DECLARED VALUE 100.00

CONSIGNEE

REF:

1 BOX

E & B HELICOPTERS LTD
BOX 1000
CAMPBELL RIV BC V9W6Y4
SHIPPER

EXPRESS	25.65
FUEL S/C	1.09
GSTBC	1.60

AERO DESIGN

CALGARY AB 403-250-8027
REFERENCE:

TOTAL 28.34

STATION TO STATION

FORM 256 REV 01.10.01

SHIPPER'S RECEIPT

SENDER RETAIN THIS COPY / COPIE DE L'EXPÉDITEUR

SENDER ACCOUNT NO. / N° DE COMPTE DE L'EXPÉDITEUR: 4367155

IMPORTANT - TELEPHONE: (403) 250 8027

SENDER FROM - EXPÉDITEUR DE: AERO DESIGN

MO DY/JR YR/AN: 05 19 05

STREET ADDRESS - ADRESSE (N° ET RUE): 2013 39TH AVE N.E. #2013

APT SUITE - APP BUREAU:

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PROV/STATE/ETAT: ALTA

POSTAL ZIP: T2E 6R7

DELIVER TO - LIVRER À: E+B HELICOPTERS

STREET ADDRESS - ADRESSE (N° ET RUE): 2595 ISLAND Hwy

APT SUITE - APP BUREAU:

CITY / VILLE: CAMPBELL RIVER

PROV/STATE/ETAT: BC

POSTAL ZIP: V9W 2H2

ATTN: (NAME / DEPT.) / À L'ATTENTION DE (NOM / SERVICE): ED WILCOCK

IMPORTANT - TELEPHONE: 250)287 4421

DESCRIPTION (INCLUDING DANGEROUS GOODS / INCLUANT MARCHANDISES DANGEREUSES): DOCUMENTS

DG ✓ MD

SENDER REFERENCE - AUTRE RÉF. DE L'EXPED.:

PICK UP / CUEILLETTE - N° DE CONF.:

0001

SENDER'S SIGNATURE - SIGNATURE DE L'EXPÉDITEUR: X Jeff Clarke X

SEE CONDITIONS OF CARRIAGE ON REVERSE / VOIR CONDITIONS DE TRANSPORT AU VERSO

SHIP MODE / MODE DE TRANSPORT

AIR / AÉRIEN: X

GROUND / ROUTIER:

PKG / EMBAL. (1 TYPE ONLY / 1 TYPE SEULEMENT)

PURO-LETTER: X

PURO-PAK:

OTHER / AUTRE:

SERVICE (1 PIECE ONLY / 1 PIÈCE SEULEMENT)

9 AM 9h:

10:30AM 10h30:

SAT. SAM.:

PAYMENT / PAIEMENT

CASH / COMPTANT:

CREDIT CARD / CARTE DE CRÉDIT:

RECEIVER OR THIRD PARTY ACCOUNT NO. / N° DE COMPTE DU DESTINATAIRE OU TIERS

RECEIVER / DESTINATAIRE:

3RD PARTY / TIERS:

SENDER / EXPÉDITEUR: X

SHIPMENT / DÉTAILS / EXPÉDITION

#/Nbre PCS (4 MAXIMUM)	WEIGHT / POIDS SUBJ TO CORR / SUJET À CORR. KG	LB
1		1

DECLARED VALUE / VALEUR DÉCLARÉE (SURCHARGE APPLIES OVER $100 / SUPPLÉMENT AU-DESSUS DE 100 $)

$ Ø

$5,000 MAX / MAX 5 000 $

SEE CONDITIONS OF CARRIAGE ON REVERSE / CONDITIONS DE TRANSPORT AU VERSO

BILL OF LADING NO / NON NÉGOCIABLE / N° DE CONNAISSEMENT / NON NÉGOCIABLE: 2241 630 6979

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COURIER INITIALS / INITIALES DU COURRIER	COURIER ROUTE / ITINÉRAIRE DU COURRIER	MO DY/JR YR/AN
		05 19 05

NO./N

TYPE ☐ VISA ☐ MC ☐ AMEX

EXP DATE D'EXP

CHARGES / FRAIS

TOTAL AMOUNT / MONTANT TOTAL

THIRD PARTY BILLING NAME & ADDRESS / FACTURATION À UN TIERS (NOM & ADRESSE)

LIMITATION OF LIABILITY - IMPORTANT - PLEASE READ
THE AMOUNT OF ANY LOSS OR DAMAGE FOR WHICH THE CARRIER MAY BE LIABLE SHALL NOT EXCEED $2.00 PER [illegible] TOTAL WEIGHT OF THE SHIPMENT UNLESS A HIGHER VALUE IS DECLARED ON THE FACE OF THE BILL OF LADING BY THE CONSIGNOR (SENDER). MAXIMUM DECLARED VALUE SHALL NOT EXCEED $5,000. N.B. NOTE CAREFULLY CONDITIONS ON BACK HEREOF INCLUDING LIMITATIONS [illegible] HEREBY ACCEPTED

LIMITATION DE RESPONSABILITÉ - IMPORTANT - LISEZ S.V.P.
LE MONTANT DE TOUTE PERTE OU DOMMAGE DONT LE TRANSPORTEUR POURRAIT ÊTRE RESPONSABLE NE DOIT PAS [illegible] SUR LE POIDS TOTAL DE L'EXPÉDITION, À MOINS QU'UNE VALEUR SUPÉRIEURE N'AIT ÉTÉ DÉCLARÉE SUR LE RECTO DU CONNAISSEMENT PAR L'EXPÉDITEUR. LA VALEUR DÉCLARÉE MAXIMALE NE DÉPASSERA PAS 5 000 $. N.B. VEUILLEZ PRENDRE CONNAISSANCE DES CONDITIONS AU VERSO, Y COMPRIS LES [illegible] QUI SONT ACCEPTÉES PAR LES PRÉSENTES.

PLEASE REFER TO BILL OF LADING NUMBER FOR SHIPMENT STATUS / INQUIRIES
POUR TOUT RENSEIGNEMENT, VEUILLEZ NOUS COMMUNIQUER LE NUMÉRO DE CONNAISSEMENT.

SENDER RETAIN THIS COPY / COPIE DE L'EXPÉDITEUR

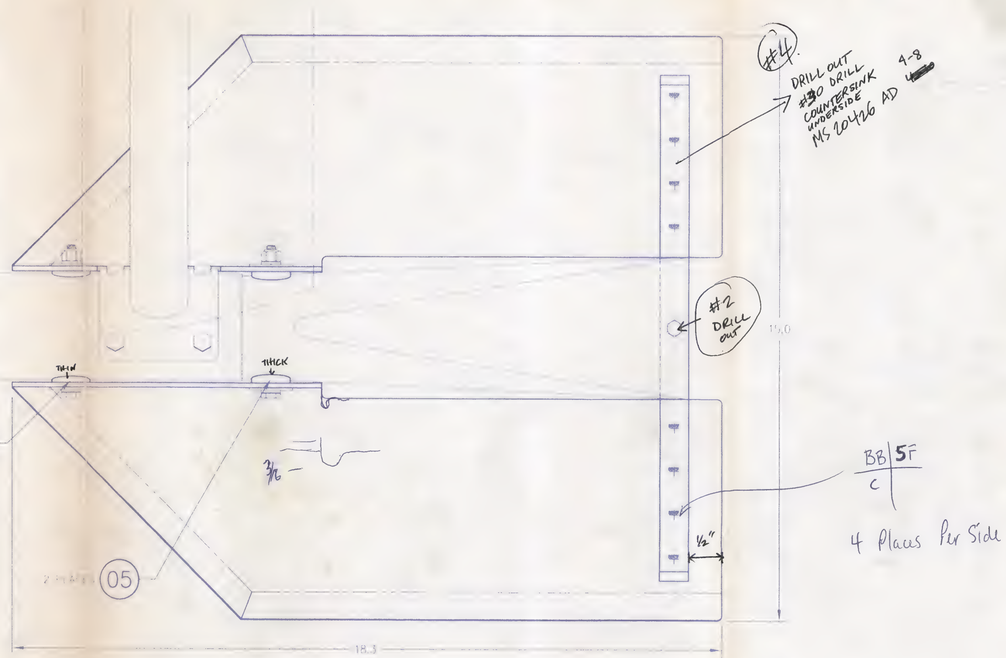
REV.	DESCRIPTION OF CHANGE	INITIALS	DATE
-	INITIAL ISSUE		

GLUE MATING SURFACES

1) DRILL SKID TUBE HOLE
2) MOUNT CROSS BAR
3) POSITION PAW INBOARD FRONT BEVEL WASHER AGAINST END OF SKID TUBE
4) AFT BOLT FIRST SEE NOTE RE-SLOT
5) BOTH BOLTS CLAMPED DRILL RIVET HOLES

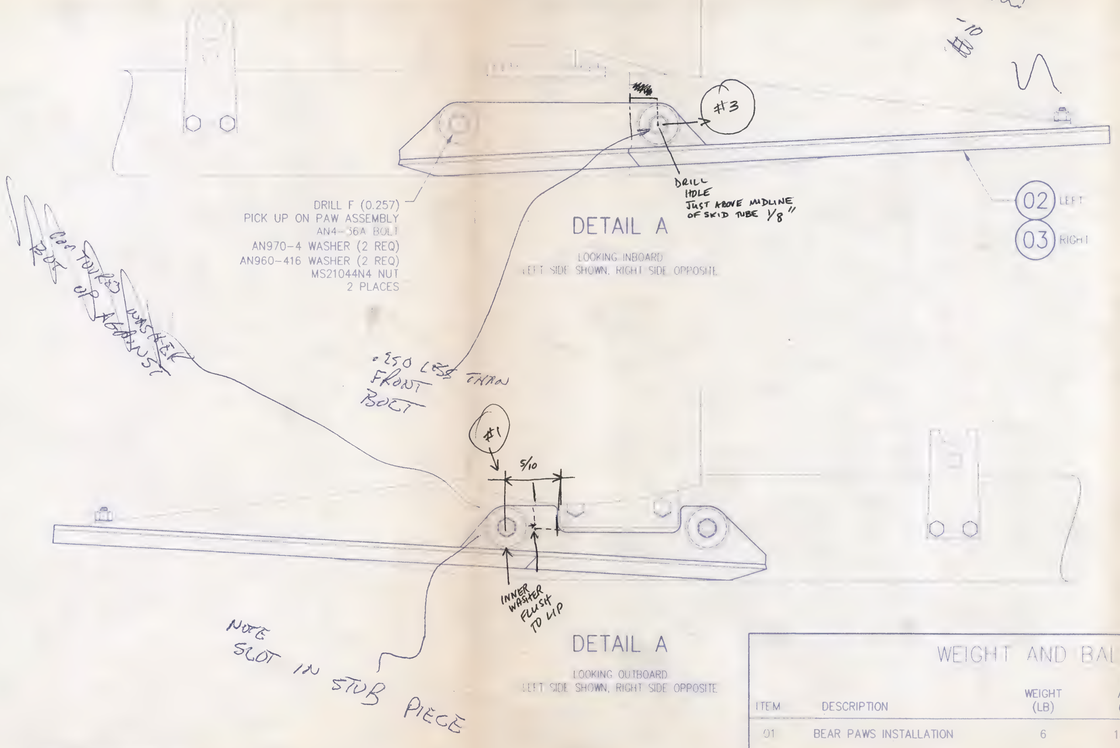
CAN'T BE DONE

EACH DIST FRONT/BACK.



01 INSTALLATION

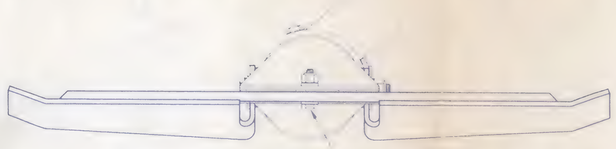
SCALE 1 : 20



1.13 ON BOLT USED

#10

ONE SIDE NEEDED
ONE - LESS.



QTY	PART NO.	ITEM	DESCRIPTION	MATERIAL	MATERIAL SPEC	STOCK SIZE
	64001-01	01	INSTALLATION			
2	MS21044N3		NUT			
A/R	AN970-10		WASHER			
2	AN3-7A		BOLT			
4	MS21044N4		NUT			
A/R	AN960-416		WASHER			
A/R	AN970-4		WASHER			
4	AN4-36A		BOLT			
4	64021-03	05	AFT SPACER			
4	64021-02	04	FWD SPACER			
1	64010-02	03	RIGHT PAW ASSEMBLY			
1	64010-01	02	LEFT PAW ASSEMBLY			

LIST OF MATERIALS

NOTES:

1. REMOVE ALL BURRS AND SHARP EDGES.
2. INSTALL ALL HARDWARE USING STANDARD SHOP PRACTICES AS OUTLINED IN AC43.13-1B, CHAPTER 7 "AIRCRAFT HARDWARE, CONTROL CABLES, AND TURNBUCKLES".

WEIGHT AND BALANCE

ITEM	DESCRIPTION	WEIGHT (LB)	LONGITUDINAL ARM (IN)	LONGITUDINAL MOMENT (LB-IN)	LATERAL ARM (IN)	LATERAL MOMENT (LB-IN)
01	BEAR PAWS INSTALLATION	6	133.6	801.6	0	0

BASIC CODE REF. NAS 523

C=COUNTERSUNK
D=DIMPLE
DIGIT=# OF SHEETS TO BE DIMPLED

DASH NO. FOR DIAMETER
N=MFD. HEAD NEAR SIDE
F=MFD. HEAD FAR SIDE

DASH NO. FOR LENGTH

BASIC CODES:
BJ = MS20470AD
BB = MS20426AD
ARN = CR3213
ARM = CR3212

INSTALL NEW RIVET
REMOVE/REPLACE RIVET
EXISTING RIVET

APPROVALS	DATE
DRAWN: JEFF CLARKE	14 FEB 2005
CHECKED: E. BURGOIN	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON:
DECIMAL: X.XXX ±0.010, X.XX ±0.04, X.X ±0.1
ANGLES: ±1/2°

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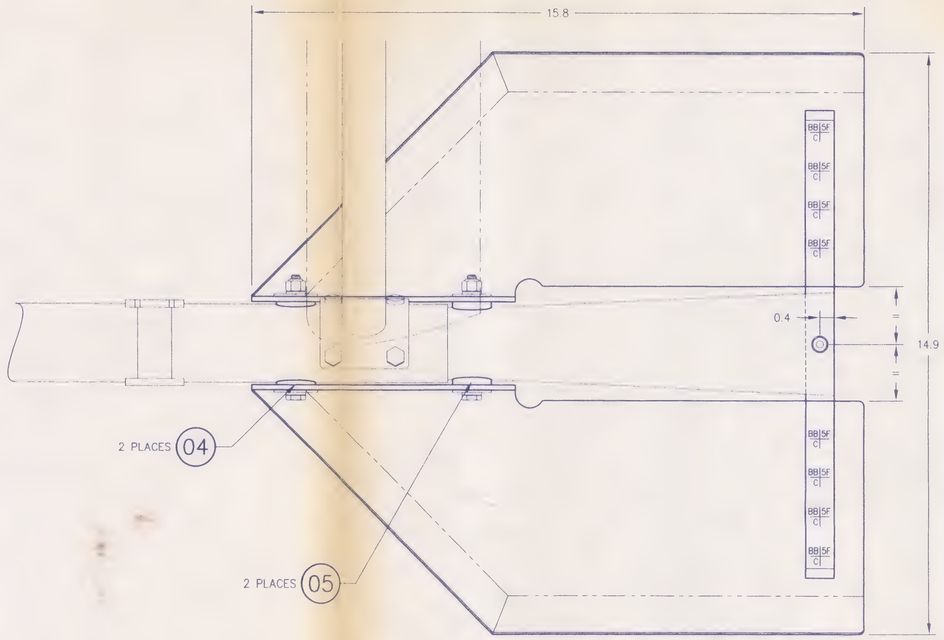
tel: (403) 250-8027 fax: (403) 250-8333 aerodesign@telusplanet.net

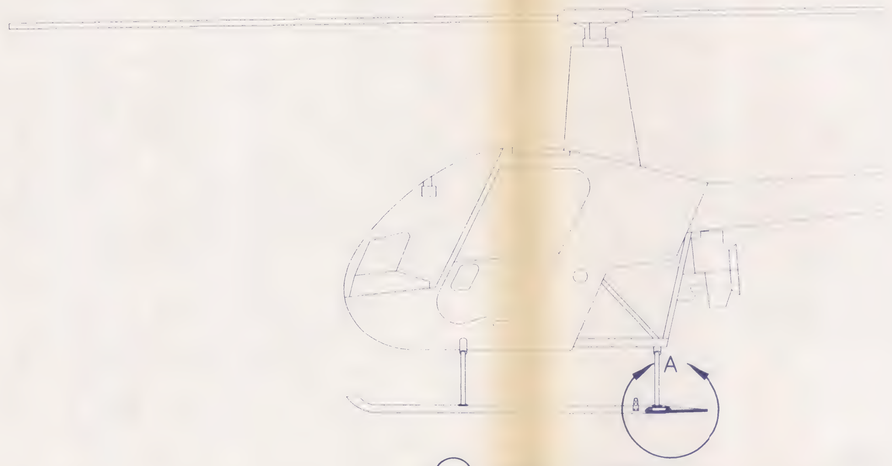
ROBINSON R44
BEAR PAWS INSTALLATION
INSTALLATION

SCALE	DWG. SIZE	DWG. NO.	REV.
1 : 2	A1	64001	0

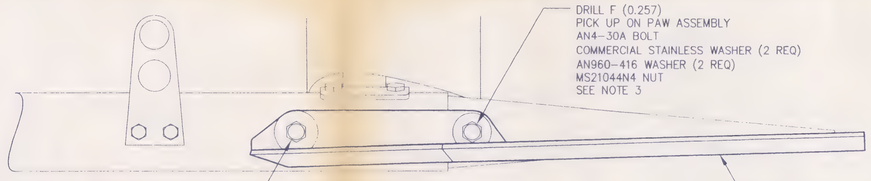
SHEET 1 OF 1

REV.	DESCRIPTION OF CHANGE	INITIALS	DATE
0	INITIAL ISSUE		



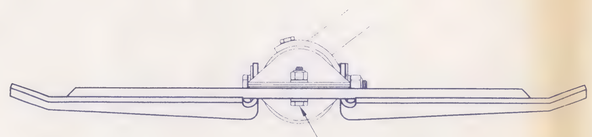


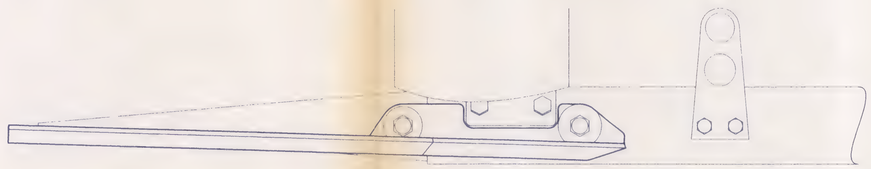
01 INSTALLATION
SCALE 1 : 1



DETAIL A

LOOKING INBOARD
LEFT SIDE SHOWN, RIGHT SIDE OPPOSITE





DETAIL A

LOOKING OUTBOARD
LEFT SIDE SHOWN, RIGHT SIDE OPPOSITE

A/R			WASHER	STAINLESS STEEL	COMMERCIAL	1.0 OD X 0.063 THICK
2	MS21044N3		NUT			
A/R	AN970-10		WASHER			
A/R	AN3-10A		BOLT			
A/R	AN3-7A		BOLT			
4	MS21044N4		NUT			
A/R	AN960-416		WASHER			
A/R	AN970-4		WASHER			
4	AN4-30A		BOLT			
4	64021-03	05	AFT SPACER			
4	64021-02	04	FWD SPACER			
1	64010-02	03	RIGHT PAW ASSEMBLY			
1	64010-01	02	LEFT PAW ASSEMBLY			
	64001-01	01	INSTALLATION			
01	PART NO.	ITEM	DESCRIPTION	MATERIAL	MATERIAL SPEC	STOCK SIZE

QTY — LIST OF MATERIALS

NOTES:

1. REMOVE ALL BURRS AND SHARP EDGES.
2. INSTALL ALL HARDWARE USING STANDARD SHOP PRACTICES AS OUTLINED IN AC43.13-1B, CHAPTER 7 "AIRCRAFT HARDWARE, CONTROL CABLES, AND TURNBUCKLES".
3. TRIM EDGE OF COMMERCIAL STAINLESS WASHER IF REQUIRED TO FIT INTO CORNER OF BEAR PAW.

WEIGHT AND BALANCE

ITEM	DESCRIPTION	WEIGHT (LB)	LONGITUDINAL ARM (IN)	LONGITUDINAL MOMENT (LB-IN)	LATERAL ARM (IN)	LATERAL MOMENT (LB-IN)
01	BEAR PAWS INSTALLATION	5	123.6	618	0	0

BASIC CODE REF. NAS 523

C=COUNTERSUNK
D=DIMPLE
DIGIT=# OF SHEETS TO BE DIMPLED

DASH NO. FOR DIAMETER
N=MFD. HEAD NEAR SIDE
F=MFD. HEAD FAR SIDE

DASH NO. FOR LENGTH

BASIC CODES:
BJ=MS20470AD
BB=MS20426AD
ARN=CR3213
ARM=CR3212

INSTALL NEW RIVET
REMOVE/REPLACE RIVET
EXISTING RIVET

APPROVALS	DATE
DRAWN: JEFF CLARKE	10 JUNE 2005
CHECKED: E. BURGOIN	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES.
TOLERANCES ON:
DECIMALS X.XXX ±0.010, X.XX ±0.03, X.X ±0.1
ANGLES ±1/2°

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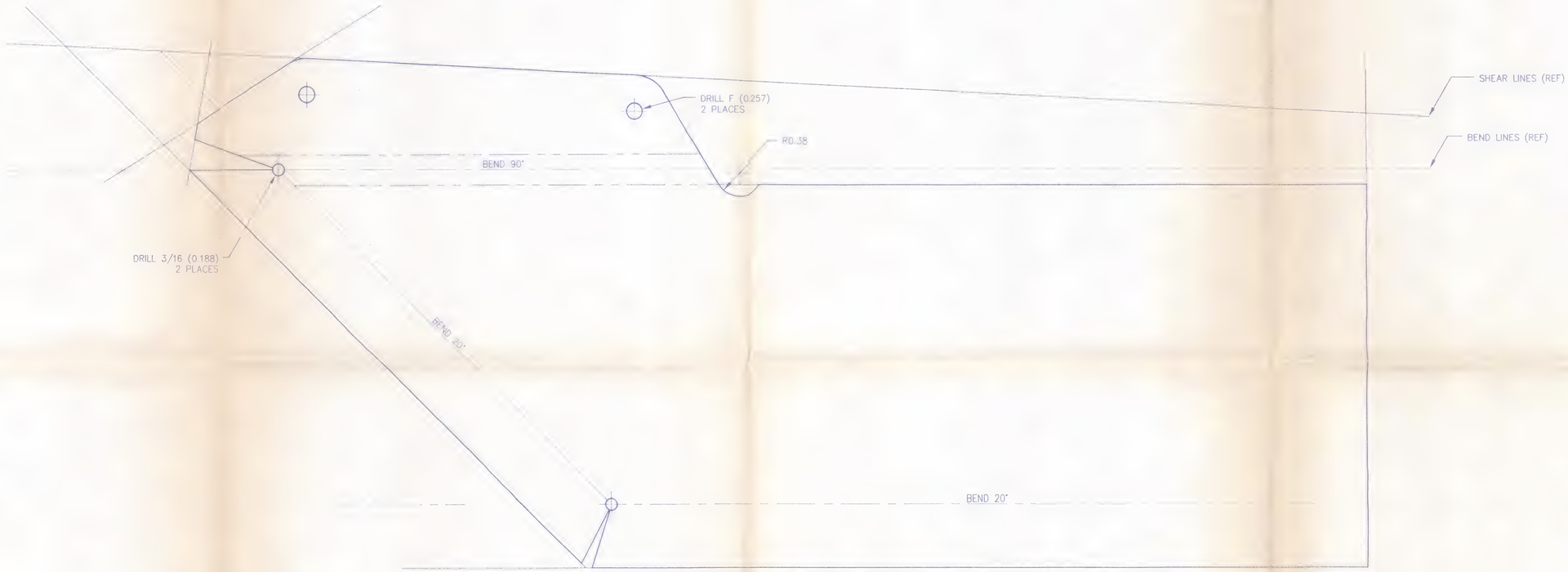
ROBINSON R22
BEAR PAWS INSTALLATION
INSTALLATION

SCALE 1 : 2	DWG. SIZE	DWG. NO.	REV.
SHEET 1 OF 1	A1	64002	0

REV.	DESCRIPTION OF CHANGE	INITIALS	DATE
01	INITIAL ISSUE		



FLAT PATTERN

USE DRAWING AS TEMPLATE FOR FABRICATION

QTY	PART NO.	ITEM	DESCRIPTION	MATERIAL	MATERIAL SPEC	STOCK SIZE
	64020-02	02	INBOARD PAW	6061-T6 ALUMINUM	QQ-A-250/11	0.125" SHEET
	64020-01	01	OUTBOARD PAW	6061-T6 ALUMINUM	QQ-A-250/11	0.125" SHEET

LIST OF MATERIALS

	APPROVALS	DATE
DRAWN:	JEFF CLARKE	14 FEB 2005
CHECKED:	E. BURGOIN	

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES.
TOLERANCES ON:

DECIMALS	ANGLES
X.XXX ±0.010	±1/2°
X.XX ±0.03	
X.X ±0.1	

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tel: (403) 250-8027 fax: (403) 250-8333 aerodesign@telusplanet.net

ROBINSON R44
BEAR PAWS INSTALLATION
PAW FABRICATION

SCALE 1 : 1	DWG. SIZE	DWG. NO.	REV.
SHEET 2 OF 2	A1	64020	0

SENDER RETAIN THIS COPY / COPIE DE L'EXPÉDITEUR

SENDER ACCOUNT NO. / N° DE COMPTE DE L'EXPÉDITEUR: 4367155

IMPORTANT - TELEPHONE: (403) 250 9027

SENDER (FROM) / EXPÉDITEUR (DE): AERO DESIGN

MO DY/JR YR/AN: 07 03 07

STREET ADDRESS ADRESSE (N° ET RUE): 2013 39 AVE NE

APT. SUITE APP. BUREAU:

CITY / VILLE: CALGARY

PROV./STATE/ÉTAT: ALTA

POSTAL / ZIP: T2E 6R7

RECEIVER (TO) / DESTINATAIRE (À): E+B HELICOPTERS

STREET ADDRESS ADRESSE (N° ET RUE): 2595 ISLAND HWY

APT. SUITE APP. BUREAU:

CITY / VILLE: CAMPBELL RIVER

PROV./STATE/ÉTAT: BC

POSTAL / ZIP: V9W 2H2

ATTN: (NAME / DEPT.) / A L'ATTENTION DE (NOM / SERVICE): ED WILCOCK

IMPORTANT - TÉLÉPHONE: (250) 2874421

DESCRIPTION (INCLUDING DANGEROUS GOODS / INCLUANT MARCHANDISES DANGEREUSES): METAL PARTS

DG / MD:

SENDER REFERENCE (IF ANY) / REF. DE L'EXPED.:

PICK UP / CUEILLETTE - N° DE CONF.: 0008

SENDER'S SIGNATURE / SIGNATURE DE L'EXPÉDITEUR: X [signature] X

SEE CONDITIONS OF CARRIAGE ON REVERSE / CONDITIONS DE TRANSPORT AU VERSO

SHIP MODE / MODE DE TRANSPORT

AIR / AERIEN: X

GROUND / ROUTIER: X

PKG / EMBAL.

SERVICE

CHOOSE 1 TYPE ONLY / CHOISIR 1 TYPE SEULEMENT

PREF. ONLY / PRÉF. SEULEMENT

PURO-LETTER:

PURO-PAK:

OTHER / AUTRE: X

9 AM 9 h:

10:30AM 10 h 30:

SAT. SAM.:

PAYMENT / PAIEMENT

CASH / COMPTANT:

CREDIT CARD / CARTE DE CRÉDIT:

RECEIVER OR THIRD PARTY ACCOUNT NO. / N° DE COMPTE DU DESTINATAIRE OU TIERS

RECEIVER / DESTINATAIRE:

3RD PARTY / TIERS:

SENDER / EXPÉDITEUR: X

SHIPMENT / DÉTAILS / EXPÉDITION

NOTE PCS (4 MAXIMUM): 1

WEIGHT / POIDS — SUBJ. TO CORR. / SUJET À CORR.

KG:

LB: 4

DECLARED VALUE / VALEUR DÉCLARÉE

SURCHARGE APPLICABLE (SUPPLÉMENT AU-DESSUS DE 100 $)

$: N/C

$5 000 MAX / MAX 5 000 $

SEE CONDITIONS OF CARRIAGE ON REVERSE / CONDITIONS DE TRANSPORT AU VERSO

BILL OF LADING NO. / NOT NEGOTIABLE / N° DE CONNAISSEMENT NON NEGOCIABLE: 2747 320 3258

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COURIER INITIALS / INITIALES DU COURRIER: MF

COURIER ROUTE / ITINÉRAIRE DU COURRIER:

MO DY/JR YR/AN: 07 03 07

NO./N°:

TYPE: VISA MC AMEX

EXP. DATE / D'EXP.:

CHARGES / FRAIS

TOTAL AMOUNT / MONTANT TOTAL

THIRD PARTY BILLING NAME & ADDRESS / FACTURATION À UN TIERS (NOM & ADRESSE)

LIMITATION OF LIABILITY - IMPORTANT - PLEASE READ

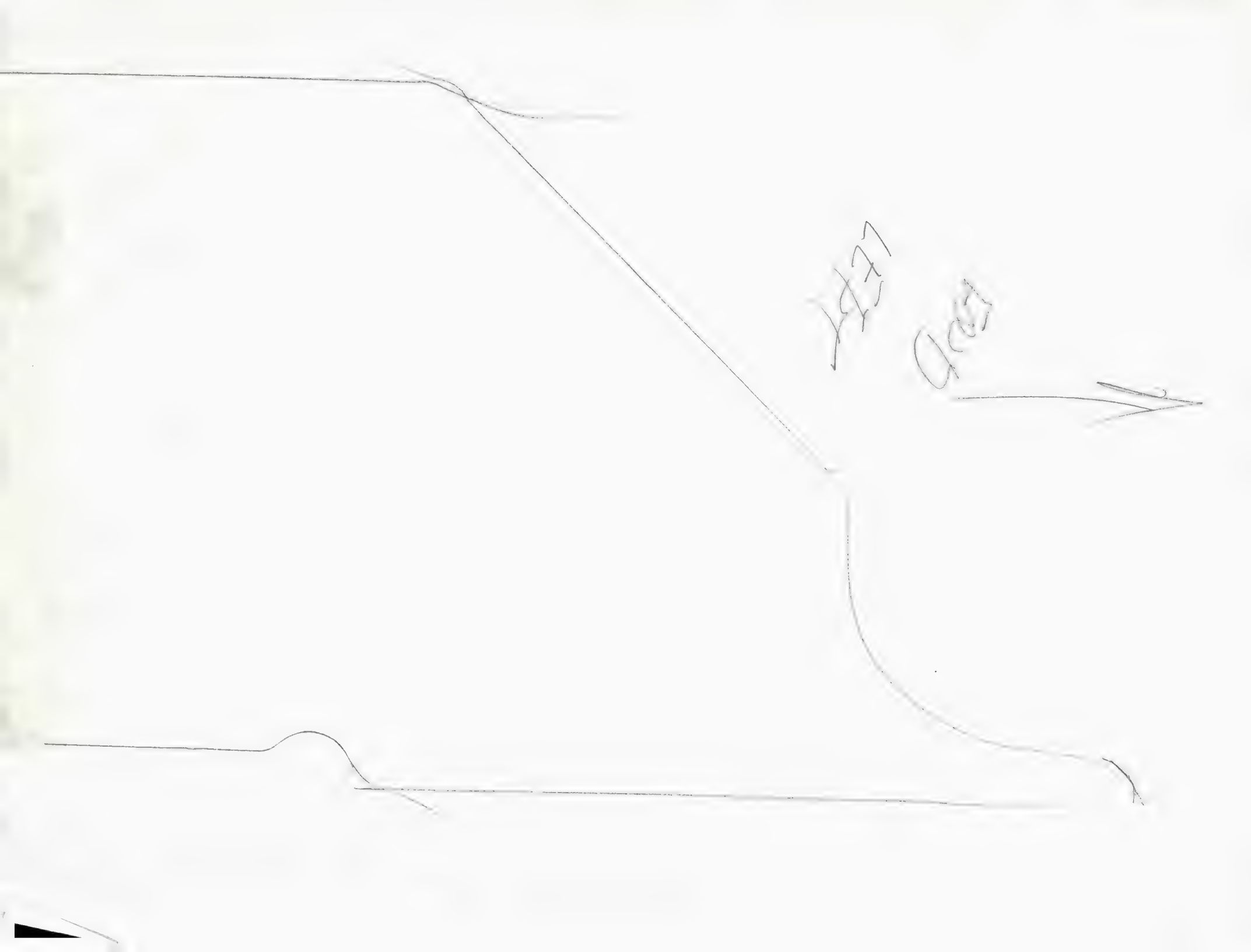
CARRIER MAY BE LIABLE SHALL NOT EXCEED $2.00 PER POUND (OR $4.41 PER KILOGRAM) COMPUTED ON THE

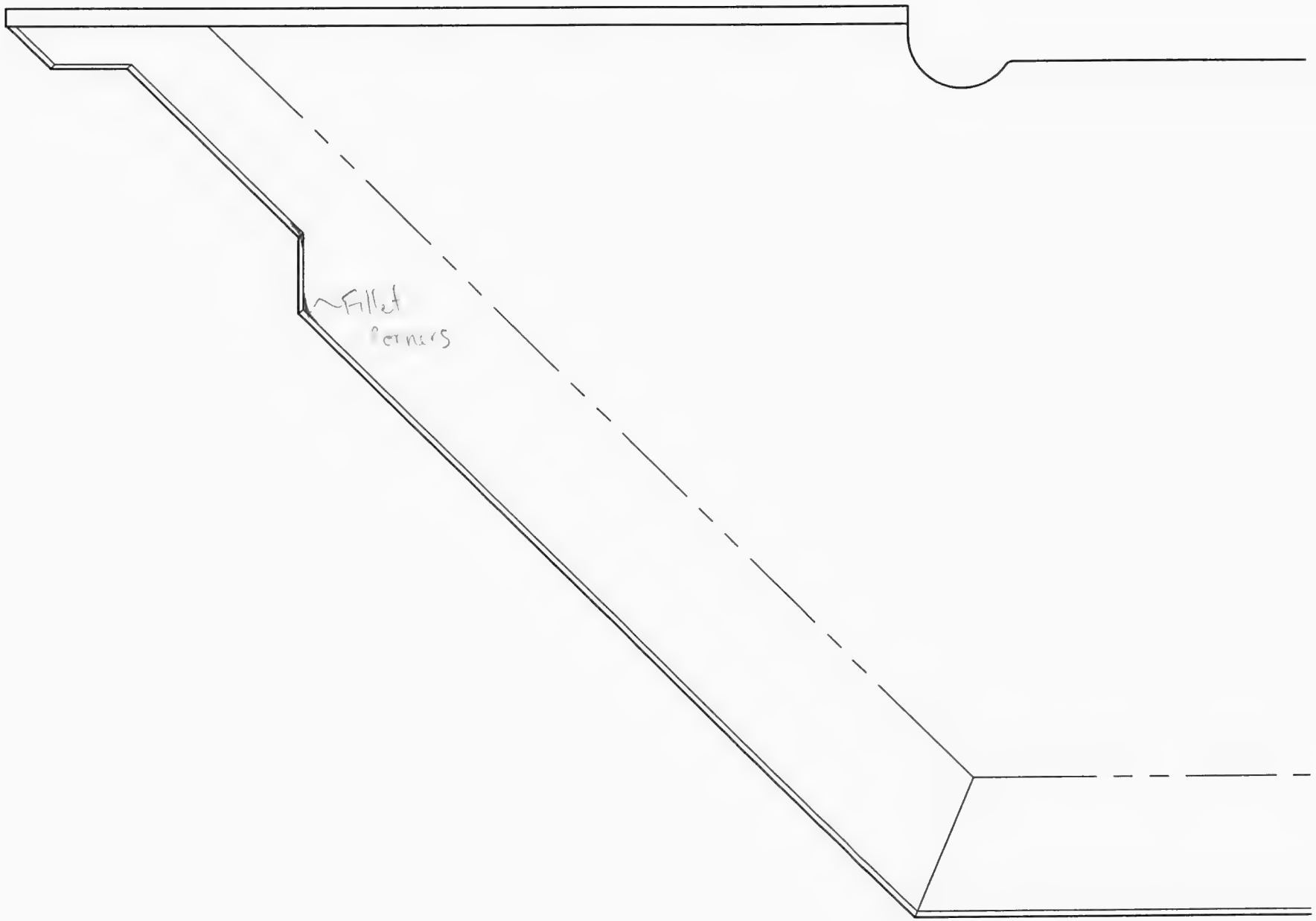
LIMITATION DE RESPONSABILITÉ - IMPORTANT - LISEZ S.V.P.

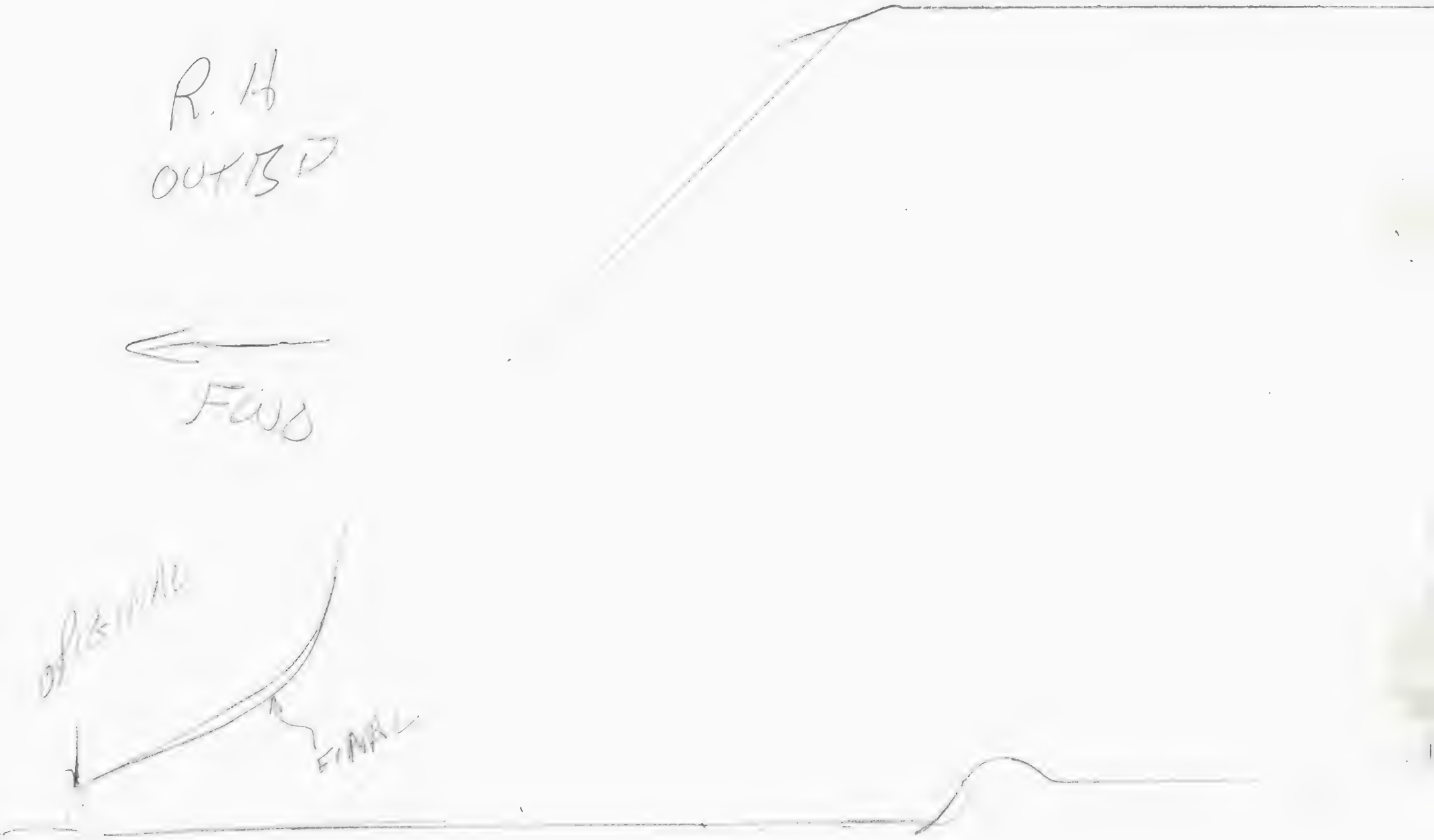
TRANSPORTEUR POURRAIT ÊTRE RESPONSABLE NE DOIT PAS EXCÉDER 2,00 $ LA LIVRE (OU 4,41 $ LE KILOGRAMME), CALCULÉ

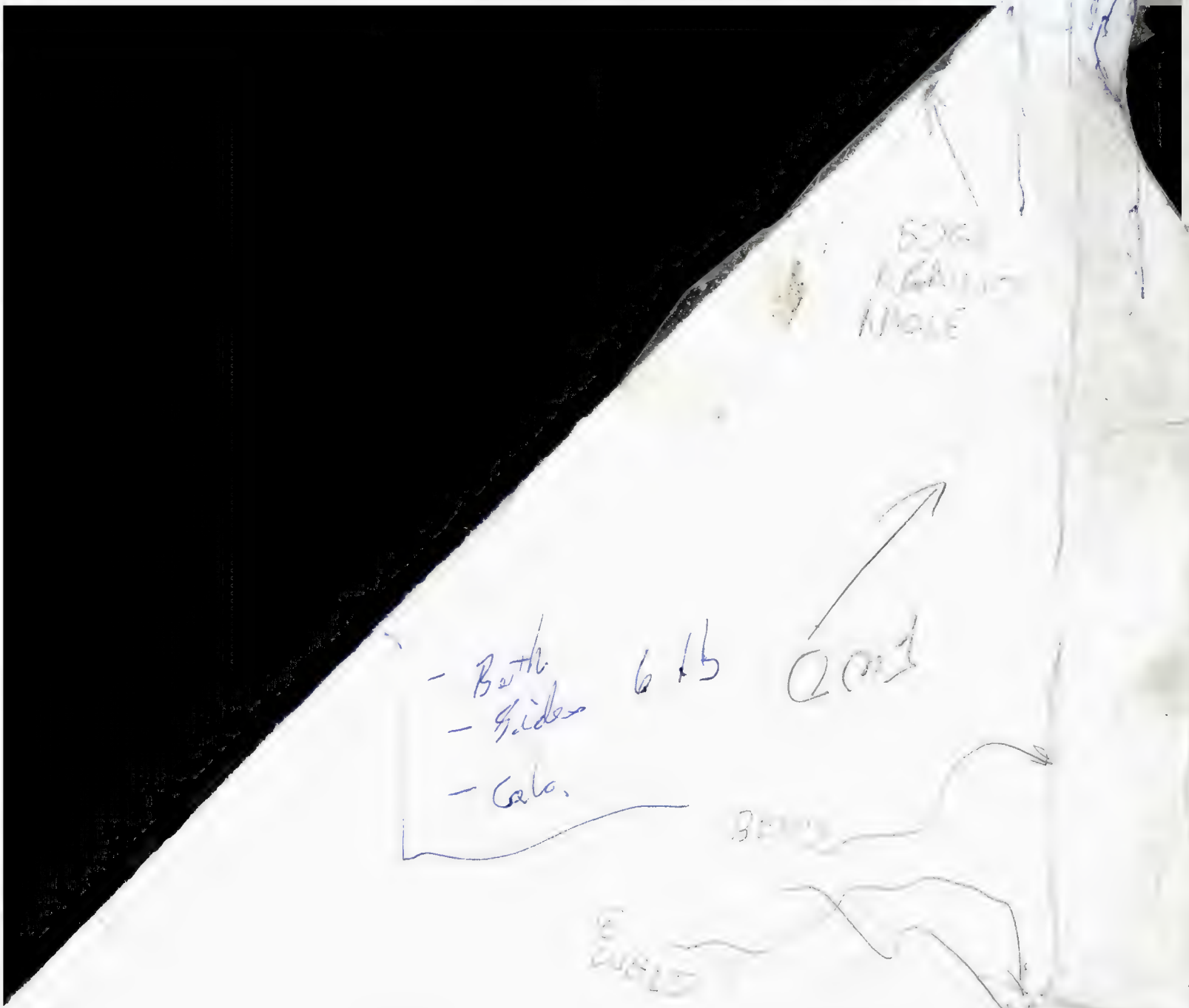
PLEASE REFER TO BILL OF LADING NUMBER FOR SHIPMENT STATUS / INQUIRIES
POUR TOUT RENSEIGNEMENT VEUILLEZ NOUS COMMUNIQUER LE NUMÉRO DE CONNAISSEMENT

SENDER RETAIN THIS COPY / COPIE DE L'EXPÉDITEUR




Fillet
corners


R. H
OUTBD
FWD
FINAL


- Bath
- Slider
- Calc.

0.4 lb. 5" mirror

Rt side interferes by 1/2"

Bolt = 0.595 + 0.026 = 0.621 in^3 × 0.283 = 0.176 lb each

Paw A = 83.21 × 0.125 × 0.1 = 1.05 lb each × 2 = 2.1

Strap = 1/4 × 3/4 × 12 = 0.23 lb 0.23

Spacers 0.019 + 0.029 = 0.05 lb 0.05

Bolts / Nuts. 0.40

2.78

3.00 each = 6 lb. total

Pull back 5/8"

R22 2.50/250-4 NHS tire on Eds

Chang Ching tire Co

R44

From: "Oucharek, Gregory" <OUCHARG@tc.gc.ca>
To: <jeff@aerodesign.ca>Cc: <ted@aerodesign.ca>
CC: <ted@aerodesign.ca>X-OriginalArrivalTime: 30 Jan 2006 20:01:50.0400 (UTC)
FILETIME=[0209D400:01C625D8]
Date: Mon, 30 Jan 2006 13:01:49 -0700
Subject: FW: R22 Bear Paw / Cargo Mirror

Jeff / Ted,

See comments from Serge below. Some minor adjustments to the Flight Test plan. I will explain to him that the Bear Paw CP revision is pending but paragraphs are as originally established for the R44. Note also that TC will retain Flight paragraphs.

Regards,

Greg

-----Original Message-----
From: Massicotte, Serge
Sent: Monday, January 30, 2006 9:45 AM
To: Oucharek, Gregory
Subject: RE: R22 Bear Paw / Cargo Mirror

Greg,

sorry for the delay in replying to your emails ... I was busy in Mirabel and also here with recurrent training for most of last week. I have reviewed the CP and test plan for the ***mirror installation*** (CP Rev 1 dated 23 Jan ' 06 and FTP 649.02 Rev 0 dated 16 Jan ' 06). I have a few minor comments as follow:

CP
27.67 Climb: OEI - definitely not required for the R22/R44;
27.177 Static Directional Stability - should be added; and
27.231 General - should be added.

FTP
Include a qualitative assessment of directional stability (27.177); and
Ensure static stability is evaluated/longitudinal cyclic position recorded at the same power setting for all speeds selected (record subject power setting).

As for the *Bear Paw* testing, I have not seen any CP specifically for the R22. The FTP is acceptable however the same comments as for the mirror FTP apply (directional stability and static stability testing).

As far as AD 95-26-04 is concerned, it do not believe subject modifications will have any impact on it. I agree with Mr Wilcox doing subject flight testing however I want TC to retain signature for the flight test para's (same as we did last time).

Let's talk if you need further clarifications.

Regards,

Serge Massicotte
Engineering Test Pilot
Aircraft Certification - Transport Canada
(613) 941-6212

-----Original Message-----
From: Oucharek, Gregory
Sent: Wednesday, January 25, 2006 1:39 PM
To: Massicotte, Serge
Subject: FW: R22 Bear Paw / Cargo Mirror
Importance: High

Serge,

Further to my voice message, please find attached a revised CP for the Cargo Mirror Installation. Ted has also requested delegation for all associated paragraphs. At this point I am seeking Flight Test acceptance of both test plans, FTP649 (Cargo Mirror) and FTP640 (Bear Paw) and a disposition on the extension of delegation request for the Flight related paragraphs (these were previously retained by FT on SH05-17). Also, I understand from a telephone conversation with Ted that the same pilot, Mr. Wilcox will be doing the flights. This was deemed acceptable on the original program.

If you have any questions or concerns, please give me a call.

Cheers,

Greg Oucharek, P. Eng
Transport Canada Civil Aviation
Senior Engineer, Aircraft Certification
Prairie & Northern Region,
Calgary, Alberta
(403) 292-4990

-----Original Message-----
From: E. Burgoin [mailto:ted@aerodesign.ca]
Sent: Wednesday, January 25, 2006 11:10 AM
To: Oucharek, Gregory
Subject: Re: R22 Bear Paw / Cargo Mirror

We will fly them as seperate tests since they will be seperate STC's. This is the requirement. As with any STC though it is up to the installer to determine that there is no incompatability with any other modification.

From my experience with this kind of thing we are concerned with vibration and this is what I am mainly checking for. We are doing the rest of the flight test because of the regulatory requirement to "go through the motions" but realistically I am not expecting to find any change from the basic configuration.

If things work out time wise I will also probably fly them together simply because the opportunity is there to do it. Again, the point of interest will be the vibration characteristics, but if we are up doing this I will spend the extra half hour to go through the whole program.

Are we just about good to go on this? As soon as your cohorts are out of here I need to be doing this. E & B has a new R22 to deliver with the bear paws on it, probably in about a week and a half.

Thanks Greg.

Ted.

----- Original Message -----
From: Oucharek, Gregory
To: E. Burgoin (E-mail)
Cc: Jeff Clarke (E-mail)
Sent: Wednesday, January 25, 2006 10:40 AM
Subject: R22 Bear Paw / Cargo Mirror

Ted,

One further point of clarification, are you planning to fly the mirror concurrently with the bear paws or are these two distinct tests as published (FTP649 vs FTP640).

Thanks for cleaning up the CP. I will continue working with Serge for acceptance but would like a response to my question.

Regards.

Greg Oucharek, P. Eng
Transport Canada Civil Aviation
Senior Engineer, Aircraft Certification
Prairie & Northern Region,
Calgary, Alberta
(403) 292-4990

Jeff Clarke

From: Oucharek, Gregory [OUCHARG@tc.gc.ca]
Sent: Thursday, March 30, 2006 8:55 AM
To: jeff@aerodesign.ca
Subject: FW: Robinson R22/R44 Mirror and Bear Paws

Comments from Serge follow ...

-----Original Message-----
From: Massicotte, Serge
Sent: Wednesday, March 22, 2006 10:34 AM
To: Oucharek, Gregory
Subject: RE: Robinson R22/R44 Mirror and Bear Paws

Hi Greg,

I have reviewed both reports and offer the following comments:

- both reports have the same mistake on page 15, Vne for the R22 is 102 kts, not 130 kts (typo suspected);
- full control travel (control throws) should be measured and recorded in order to properly assess control margins; and
- usually, longitudinal control positions are measured at a given power setting for all airspeeds (the power required to maintain level flight at 0.9 Vh/0.9 Vne). Depending on the speed tested, a slight climb or descent is accepted. It also provides for a more accurate method when comparing control positions between the clean and modified aircraft. I'm not too worried about it in this particular case as the modifications involved are quite small.

I'm willing to accept Jeff's test results as I feel confident there is no safety issues with the installation of the mirror or bear paws however AeroDesign should address these shortcomings in future reports.

Regards,

Serge Massicotte
Engineering Test Pilot
Aircraft Certification - Transport Canada
(613) 941-6212

-----Original Message-----
From: Jeff Clarke [mailto:jeff@aerodesign.ca]
Sent: Friday, March 03, 2006 1:49 PM
To: Oucharek, Gregory; Massicotte, Serge
Subject: Robinson R22/R44 Mirror and Bear Paws

Serge/Greg,

Attached are the Flight Test Plans for the Mirror and Bear Paws installations. They have been bumped up a revision with the Flight Test Reports added to appendix A and weight and balance to appendix B.

Please advise if you have any questions or concerns.

Jeff Clarke
Technologist

AERO Design Ltd.

AERO DESIGN LTD.
2013 – 39 Avenue N.E., Calgary, Alberta, T2E 6R7

Tel: 403-250-8027
Fax: 403-250-8333
aerodesign@telusplanet.net

31 March, 2006

Transport Canada
Aircraft Certification Division
800-1601 Airport Road
Calgary, Alberta
T2E 6Z8

Attn: Greg Oucharek

Your File : C-05-0255
Our File : 640

Re: Robinson R44/R22 Bear Paws

Greg,

Please find attached the following documents related to this project:

R22 Bear Paws		
AE 100 Form	AE640-2	Revision 0
Compliance Program	CP640	Revision 3
Document Control List	DCL640-2	Revision 0
Engineering Report	ER640.02	Revision 0
Drawings		
Bear Paws Installation	64002	Revision 0
Paw Assembly	64011	Revision 0
Paw Fabrication	64025, Sht. 1	Revision 0
Paw Fabrication	64025, Sht. 2	Revision 0
Parts Fabrication	64026	Revision 0
R44 Bear Paws		
AE 100 Form	AE640	Revision 1
Document Control List	DCL640	Revision 1
Drawings		
Bear Paws Installation	64001	Revision 0
Paw Assembly	64010	Revision 0
Paw Fabrication	64020, Sht. 1	Revision 0
Paw Fabrication	64020, Sht. 2	Revision 0

The R44 Installation has some minor changes to simplify fabrication.

Regards,

E. Burgoin, P.Eng, DAR 290M

Encl.

CP INITIALED BY TED

FORM AE-100

DEPARTMENT OF TRANSPORT STATEMENT OF COMPLIANCE OF AIRCRAFT OR AIRCRAFT COMPONENTS WITH THE AIRWORTHINESS REQUIREMENTS		AE-100 No.: Initial Issue Date: Revision: Revision Date: Approval No.: Delegation No.: Delegate Name: Classification of Designee: Employer:	AE649-2 31 March, 2006 0 SH05-17 290M E. Burgoin *AERO* Design Ltd.
Aircraft Mfgr: Robinson Aircraft Model: R22, all variants Registration: All Eligible	Model Type Airplane ☐ Helicopter ☒ Appliance ☐ Component ☐		

LIST OF APPROVED REPORTS AND DATA

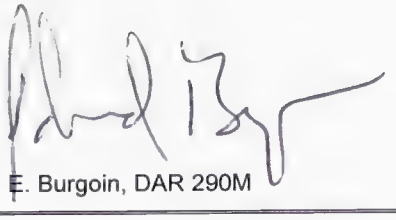
Document Number		Document Title	Compliance Status
DCL649-2	Revision 0	Document Control List and all documents referred to therein	
ER640.02	Revision 0	Engineering Report	As per Compliance Program, CP640, Revision 3 (Attached)
64002	Revision 0	Bear Paws Installation	
64011	Revision 0	Paw Assembly	
64025, Sht. 1/2	Revision 0	Paw Fabrication	
64025, Sht. 2/2	Revision 0	Paw Fabrication	
64026	Revision 0	Parts Fabrication	
		DATA APPROVED BY TRANSPORT CANADA	
FTP640.03	Revision 2	Flight Test Plan	
ICA640.91	Revision 0	Instructions for Continued Airworthiness	

CERTIFICATION

UNDER THE AUTHORITY VESTED IN ME BY THE DEPARTMENT OF TRANSPORT, I HEREBY CERTIFY THAT THE DATA LISTED ABOVE AND ON THE ATTACHED SHEETS NUMBERED Nil HAVE BEEN EXAMINED IN ACCORDANCE WITH ESTABLISHED PROCEDURES AND FOUND TO COMPLY, TO THE BEST OF MY KNOWLEDGE AND BELIEF WITH THE PERTINENT COMPLIANCE REQUIRMENTS.

I THEREFORE [☐] RECOMMEND FOR APPROVAL OF THESE DATA

[☒] APPROVE THESE DATA



E. Burgoin, DAR 290M

FORM AE-100

DEPARTMENT OF TRANSPORT STATEMENT OF COMPLIANCE OF AIRCRAFT OR AIRCRAFT COMPONENTS WITH THE AIRWORTHINESS REQUIREMENTS		AE-100 No.: Initial Issue Date: Revision: Revision Date: Approval No.: Delegation No.: Delegate Name: Classification of Designee: Employer:	AE640 12 April, 2005 1 31 March, 2006 SH05-17 290M E. Burgoin *AERO* Design Ltd.
Aircraft Mfgr: Robinson Aircraft Model: R44, R44 II Registration: AIII Eligible	Model Type Airplane ☐ Helicopter ☒ Appliance ☐ Component ☐		

LIST OF APPROVED REPORTS AND DATA

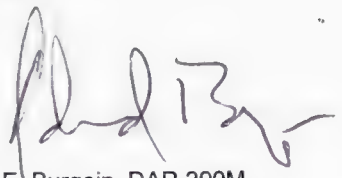
Document Number		Document Title	Compliance Status
DCL640	Revision 1	Document Control List and all documents referred to therein	
64001	Revision 1	Bear Paws Installation	
64010	Revision 1	Paw Assembly	
64020, Sht. 1/2	Revision 1	Paw Fabrication	
64020, Sht. 2/2	Revision 1	Paw Fabrication	
		DATA APPROVED BY TRANSPORT CANADA	

CERTIFICATION

UNDER THE AUTHORITY VESTED IN ME BY THE DEPARTMENT OF TRANSPORT, I HEREBY CERTIFY THAT THE DATA LISTED ABOVE AND ON THE ATTACHED SHEETS NUMBERED Nil HAVE BEEN EXAMINED IN ACCORDANCE WITH ESTABLISHED PROCEDURES AND FOUND TO COMPLY, TO THE BEST OF MY KNOWLEDGE AND BELIEF WITH THE PERTINENT COMPLIANCE REQUIRMENTS.

I THEREFORE [☐] RECOMMEND FOR APPROVAL OF THESE DATA

[☒] APPROVE THESE DATA



E. Burgoin, DAR 290M

DOCUMENT CONTROL LIST

DOCUMENT NO.	DOCUMENT CONTENT	REVISION
INSTALLATION DOCUMENTS		
64002	Bear Paws Installation	0
ICA640.91	Instructions for Continued Airworthiness	0
FABRICATION DOCUMENTS		
64011	Paw Assembly	0
64025, Sheet 1	Paw Fabrication	0
64025, Sheet 2	Paw Fabrication	0
64026	Parts Fabrication	0
ENGINEERING DOCUMENTS		
ER640.02	Engineering Report	0
FTP640.03	Flight Test Plan	2

APPROVAL:

ORIGINAL DATE:

23 February, 2006

REVISION DATE:

AERO DESIGN LTD.
2013 – 39th Ave NE
Calgary, Alberta
T2E 6R7
Ph. (403) 250-8027
Fax. (403) 250-8333

SHEET 1 OF 1

Robinson R22
Bear Paws Installation

DCL640-2

Rev. **0**

DOCUMENT CONTROL LIST

DOCUMENT NO.	DOCUMENT CONTENT	REVISION
INSTALLATION DOCUMENTS		
64001	Bear Paws Installation	1
ICA640.90	Instructions for Continued Airworthiness	0
FABRICATION DOCUMENTS		
64010	Paw Assembly	1
64020, Sheet 1	Paw Fabrication	1
64020, Sheet 2	Paw Fabrication	1
64021	Parts Fabrication	0
ENGINEERING DOCUMENTS		
ER640.01	Engineering Report	0
FTP640.02	Flight Test Plan	1

APPROVAL:

ORIGINAL DATE:

12 April, 2005

REVISION DATE:

23 February, 2006

AERO DESIGN LTD.
2013 – 39th Ave NE
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SHEET 1 OF 1

Robinson R44, R44 II
Bear Paws Installation

DCL640

Rev.

1

AERO **DESIGN LTD.**
2013 – 39th Ave N. E., Calgary, Alberta, T2E 6R7 aerodesign@telusplanet.net

F A X C O V E R S H E E T

DATE:	April 12, 2006	**TIME:**	9:15 AM
TO:	**Greg Oucharek**	**PHONE:**	403-292-4990
	Transport Canada	**FAX:**	403-292-4992
FROM:	J. Clarke Aero Design Ltd.	**PHONE:** **FAX:**	403-250-8027 403-250-8333

Number of pages including cover sheet: 4

RE: R44/R22 BEAR PAWS AND MIRROR

Greg,

Please find attached the B043 Conformity Inspections.

Jeff Clarke

Jeff

AERO Design Ltd.

FLIGHT TEST PLAN

FTP 640.03

Installation of Bear Paws

Robinson R-22

Revision 2
15 February, 2006

AERO Design Ltd.
Engineering Consultants

2013 – 39th Avenue N.E., Calgary, Alberta T2E 6R7
Phone: (403) 250-8027
Fax: (403) 250-8333
E-Mail: aerodesign@telusplanet.net

Emailed to Greg / Serge Mar 3/06

TABLE OF CONTENTS

1.0 INTRODUCTION

Bear Paws are installed on the Robinson R22 series to improve stability when landing on soft terrain, such as snow.

2.0 REFERENCE

Rotorcraft Flight Manual, Robinson R22

Aero Design Ltd. Installation Drawing 64002, Bear Paws.

3.0 BASIS OF CERTIFICATION

R22, R22 Alpha, R22 Beta, R22 Mariner

Type Certificate H10WE

FAR 27, including Amendment 27-10.

This flight test programme will demonstrate that the installation of Bear Paws complies with the flight requirements of FAR 27 including amendment 27-24 (Robinson R44 basis of certification).

4.0 FLIGHT TEST PREPARATION

4.1 General

The flight crew should review and be familiar with the regulatory requirements of FAR 27 Subpart B - Flight prior to conducting flight tests. These requirements are included as Appendix C.

The flight crew should examine and be familiar with the modification installed including a review of the proposed Flight Manual Supplement (if any).

The relative cyclic stick position in the various flight conditions is to be determined by attaching light retracting type tape measures between the cyclic stick and the airframe in both the longitudinal and lateral directions.

Test points must be flown accurately allowing the aircraft to stabilize before data is recorded.

Each limiting condition should be approached with caution, using an incremental build-up approach.

The flight crew should always be attentive to unusual noises, vibrations, control characteristics, attitudes and instrument indications.

4.2 Configuration

Baseline flight

The helicopter shall be in the same configuration as flown for the modification flight test except that the external portions of the modification shall be removed. The helicopter shall be ballasted to obtain the same gross weight and centre of gravity as flown for the modification flight test.

Modification flight test

Those components of the modification which alter the external profile of the aircraft shall be installed in accordance with the applicable installation drawings.

Any other unusual or particularly large external modifications should be removed if practical and all external modifications installed during flight testing should be noted in the flight test report.

The aircraft is to be ballasted to its maximum gross weight.

4.3 Flight Authority

The Certificate of Airworthiness may not be valid after the modification has been installed. Flight Authority in the form of a flight permit may be required.

Flight authority to exceed the published V_{ne} of the helicopter is required. When the V_{ne} for the modification as provided in the proposed Flight Manual Supplement does not restrict the maximum speed to less that 90% of the basic helicopter V_{ne} then, the flight permit should specifically state that a higher V_{ne} is authorized.

4.4 Definitions

Stability: It shall be possible to fly the helicopter in normal maneuvers for a continuous period of time appropriate to the operational use of the particular type of helicopter without the pilot experiencing undue fatigue or strain.

Static longitudinal stability: The characteristics of the longitudinal cyclic control shall be such that, with constant throttle and collective pitch settings, a rearward displacement of the longitudinal control shall be necessary to obtain and maintain speeds below the specified trim speed, and a forward displacement shall be necessary to obtain and maintain speeds above the specified trim speed.

Adequate control margins: There is adequate control and stick movement available from the position at the trim speed to the control stops or other obstructions to stick movement to safely control the helicopter.

5.0 FLIGHT TEST PROCEDURE

5.1 Flight Characteristics

Controllability Stability Flutter and Vibration

FAR 27.141, 27.143, 27.171, 27.175, 27.177 and 27.629

Low Speed

FAR 27.141(b), 27.143(a), 27.143(c), 27.171, 27.175(d) and 27.629

Hover in a fixed position at a skid height of approximately 5 – 15 ft above the ground

Translate in both sideward directions and in a rearward direction into the prevailing wind until airspeed estimated to be 17 knots (20 mph) has been reached.

Record:
- adequate control margins
- Relative lateral and longitudinal stick position (tape measurement)
- Observe and record any indications of flutter or vibrations

Climb

FAR 27.141(b), 27.143(a), 27.171, 27.175(a), 27.177 and 27.629

At the recommended climb speed, V_y, from the Basic Flight Manual increase power slowly until reaching Maximum Continuous Power

Make a 30° bank turn to the left and to the right

Record:
- adequate control margins
- Relative lateral and longitudinal stick position
- Positive static longitudinal stability
- Qualitative assessment of directional stability
- Observe and record any indications of flutter or vibrations

Level Flight

FAR 27.141(b), 27.143(a), 27.171, 27.175(b), 27.177, and 27.629

Transition from hover to forward flight increasing the speed incrementally in 10 mph steps until Maximum Continuous Power is being applied, or V_{ne} from the proposed Flight Manual Supplement is reached, whichever is less.

At each speed increment make a 30° bank turn to the left and the right

Record:
- adequate control margins
- Relative lateral and longitudinal stick position
- Positive static longitudinal stability
- Qualitative assessment of directional stability
- Observe and record any indications of flutter or vibrations

In the basic Flight Manual, V_{ne} is 98 KCAS.

At Maximum Continuous Power, V_h, or V_{ne} from the proposed Flight Manual Supplement, whichever is less

FAR 27.143(a)

Record:
- stable airspeed, V_h
- record if V_{ne} was reached prior to applying MCP

Continue to accelerate the aircraft in 10 mph increments by maintaining Maximum Continuous Power and descending as necessary V_{ne} is reached.

FAR 27.143(b) and 27.629

At each speed increment make a 30° bank turn to the left and to the right

At V_{ne} ensure there are adequate control margins and adequate pitch control

Record:
- adequate control margins
- Relative lateral and longitudinal stick position
- Positive static longitudinal stability
- Observe and record any indications of flutter or vibrations

For the flight test with modification installed only

Compare the longitudinal stick position (as measured with the measuring tape attached to the cyclic stick) for modification installed flight test to the position obtained in the baseline flight at V_{ne} this point. If the longitudinal stick position is further forward at V_{ne} with the modification installed (basic helicopter V_{ne} or proposed Flight Manual Supplement V_{ne}, whichever is less) than was determined during the baseline flight at V_{ne} then it may be necessary to further limit the V_{ne} with the modification installed due to mast bending considerations.

Applying power as required, and further descending the helicopter if necessary, cautiously accelerate the helicopter until the longitudinal cyclic stick position is in the same location as was determined in the baseline flight at V_{ne} from the basic helicopter Flight Manual.

Record:
- speed at which, for the modification installed, longitudinal cyclic stick position is in the same location as was determined in the baseline flight at the V_{ne}.

Autorotation

FAR 27.141(b), 27.143(a)(v), 27.143(d), 27.175(c) and 27.629

At each of V_y, normal cruise speed and V_h, from level flight (if possible) simulate a sudden engine failure by rapidly retarding the throttle to the idle position. The collective stick must be kept in the power-on position for at least one (1) second after the throttle is retarded before any response is made.

Record:
- assess that autorotation entry characteristics not changed from basic aircraft
- observe and report any unusually rapid rotor speed decay.
- For entry speed at V_h, adequate pitch and roll control

During descent, vary forward speed between 50% $V_{min\ rate\ of\ descent}$ and $V_{ne\ autorotation}$, making gentle turns to the left and to the right.

Record:
- adequate control margins
- unusual pitch, roll or yaw rates
- observe and record any indications of flutter or vibrations

5.2 Performance

FAR 27.65(b)

If the external modification is of significant size and shape as to affect the climb performance of the helicopter the following procedure shall be included in the flight test.

On a compass heading at 90° to the local wind conditions, from level flight at the recommended climb speed, V_y, increase power to Maximum Continuous Power maintaining airspeed. When a steady rate of climb is established, note the altimeter reading and measure the time to climb through an altitude of 1000 ft.

Record:
- Starting altitude
- Time to climb through 1000 ft.

Repeat the above procedure on the reciprocal compass heading starting at the same altitude

Record:
- Starting altitude
- Time to climb through 1000 ft.

5.3 Flight at Demonstration Speed

FAR 27.629, 27.309 and 27.1505(a)

Caution: The rotorcraft should be maneuvered gently above V_{ne}

The aircraft should be accelerated slowly above V_{ne} to ensure the target airspeed is not passed.

Applying Maximum Continuous Power and descending the aircraft as required, cautiously accelerate the aircraft to 1.11 times V_{ne}

Make a 30° bank turn to the left and the right

Record:
- maximum airspeed attained
- observe and record any indications of flutter or vibrations

In the basic Flight Manual, V_{ne} is 98 KCAS, therefore V_d must not exceed 109 KCAS.

5.4 Take off and Landing

FAR 27.51(a)(1), 27.75(a)(1) and 27.231

With the modification installed, perform a landing on soft ground. Observe for tendency of the installation to stick or catch in the soft ground, or any other condition that may create a hazard.

Take off from soft ground. Observe for tendency of the installation to stick or catch in the soft ground, or any other condition that may create a hazard.

5.5 Other Observations

Effect of modification on normal and emergency procedures

Record:
- Comment

Effect of modification on normal and emergency egress

Record:
- Comment

Evaluation of modification Flight Manual Supplement

Record:
- Comment

APPENDIX A

FLIGHT TEST REPORT

Aircraft: C-FBXP
Robinson R22, Serial no. 3730

02 February 2006
Location: Campbell River BC

Configuration: 1370 lbs. at take-off (max. gross weight for V_{ne} at 102 KIAS.)
CG at 95.64 (limited by fuel and occupant location – no additional ballast)
Bear Paws not installed.
No other external modifications installed on the aircraft.

Crew: Pilot: Ed Wilcock, E & B Helicopters
DAR: Ted Burgoin, Aero Design Ltd.

Base Line Flight without either: BearPaws installed
Right Skid Tube Mirror

Low Speed Controllability	Cyclic Stick Tape Position Lateral	Long.
- stationery hover	21.25	29.75
- sideward flight to 20 mph to right	22.0	29.5
- sideward flight to 20 mph to left	20.75	29.5
- backward flight to 20 mph	21.5	30.25

Observations:

a) adequate control margins were maintained.

Forward Flight

- cruise	60 kts -- Manifold Pressure	16.8 "Hg	
	straight ahead	22.0	26.5
	left turn – 30 degrees bank	23.0	26.75
	right turn – 30 degrees bank	22.5	26.5
- cruise	70 kts -- Manifold Pressure	16.8 "Hg	
	Straight ahead	23.0	26.25
	left turn – 30 degrees bank	22.5	26.5
	right turn – 30 degrees bank	23.0	26.5
- cruise	80 kts -- Manifold Pressure	18.0 "Hg	
	Straight ahead	23.0	26.0
	left turn – 30 degrees bank	23.0	25.75
	right turn – 30 degrees bank	23.0	26.0
- cruise	90 kts -- Manifold Pressure	20.5 "Hg	
	Straight ahead	23.0	25.0
	left turn – 30 degrees bank	23.25	25.0
	right turn – 30 degrees bank	23.25	25.0
- cruise	Max continuous power -- Manifold Pressure	24.0 "Hg	

Alt: 1,000 ft. ASL
V_h: 95 kts.

Straight ahead	23.5	24.25
left turn – 30 degrees bank	23.5	24.25
right turn – 30 degrees bank	24.0	24.0

-cruise Max continuous power
Alt: 1,500 ft. ASL descending to achieve V_{ne}
V_{ne}: 102 kts.

Straight ahead	23.5	24.0
left turn – 30 degrees bank	23.5	23.75
right turn – 30 degrees bank	23.0	24.0

Observations:

- adequate control margins were observed at each of the above listed flight speeds.
- positive longitudinal stability was observed at each flight speed.

Climb Flight

- steady climb 55 kts (V_y)
Manifold Pressure: 18 "Hg

straight ahead		
left turn – 30 degrees bank	22.0	26.5
right turn – 30 degrees bank	23.0	26.5

- Max Continuous Power 55 kts (V_y)
Manifold Pressure: 24 "Hg

straight ahead	21.75	27.0
left turn – 30 degrees bank	23.5	26.5
right turn – 30 degrees bank	23.25	26.5

Compass heading: 300°
Start Altitude: 800 ft. ASL
End Altitude: 1,800 ft. ASL
Start time: :50
End time: 1:37
Elapsed time to climb: 0 min 47 seconds
Calculated rate of climb: 1,277 ft./min.

Max Continuous Power 55 kts (V_y)

Compass heading: 120°
Start Altitude: 800 ft. ASL
End Altitude: 1,800 ft. ASL
Start time: :03
End time: 0:53
Elapsed time to climb: 0 min 50 seconds
Calculated rate of climb: 1,200 ft./min.

Observations:

- adequate control margins were observed at each of the above listed flight speeds.
- positive longitudinal stability was observed at each flight speed.

Autorotation

Entry speed: 65 kts
Entry altitude: 1,800 ft. ASL

Stick position during descent	23.0	28.0
Entry characteristics acceptable		
Descent flight characteristics acceptable		

Entry speed: 95 kts, then slowed down thru 85, 80, 70, 65 kts.
Entry altitude: 1,950 ft. ASL

Entry characteristics acceptable
Descent flight characteristics acceptable

Flight with Bear Paws Installed

Configuration: As in baseline flight except that the Bear Paws were installed, mirror not installed.

Low Speed Controllability	Cyclic Stick Tape Position Lateral	Long.
- stationery hover	21.5	29.5
- sideward flight to 20 mph to right- adequate pedal remaining	22.0	29.25
- sideward flight to 20 mph to left – adequate pedal remaining	20.5	29.0
- backward flight to 20 mph - neutral pedal	21.25	30.0

Observations:

- adequate control margins were maintained during each of the low speed flights.
- there was no visual indication of vibration of either the bear paws or the landing gear assembly.

Forward Flight

- cruise	60 kts Manifold Pressure: 16.1 "Hg		
	straight ahead	23.0	27.0
	left turn – 30 degrees bank - neutral pedal	22.5	26.75
	right turn – 30 degrees bank - neutral pedal	22.75	26.75
- cruise	70 kts Manifold Pressure: 16.0 "Hg		
	straight ahead	22.5	26.0
	left turn – 30 degrees bank - neutral pedal	22.25	26.0
	right turn – 30 degrees bank - neutral pedal	22.75	26.0
- cruise	80 kts Manifold Pressure: 17.8 "Hg		
	Straight ahead	22.75	25.5
	left turn – 30 degrees bank - neutral pedal	22.75	26.25
	right turn – 30 degrees bank - neutral pedal	23.0	26.0
- cruise	90 kts		
	Straight ahead	23.25	25.0
	left turn – 30 degrees bank - neutral pedal	23.0	25.25
	right turn – 30 degrees bank - neutral pedal	23.5	25.0

- cruise Max. continuous power
Manifold pressure: 24.0,
Engine RPM: 100%
Vh: 95 KIAS

Straight ahead	22.5	26.0
left turn – 30 degrees bank - neutral pedal	22.5	25.25
right turn – 30 degrees bank - neutral pedal	23.25	26.0

-cruise Max continuous power
Alt: 1,800 ft. ASL descending to achieve V_{ne}
V_{ne}: 130 kts.

Straight ahead	23.5	24.0
left turn – 30 degrees bank - neutral pedal	23.5	24.0
right turn – 30 degrees bank - neutral pedal	23.5	24.25

From BASELINE flight (see previous):
Max continuous power
Alt: 1,200 ft. ASL descending to achieve V_{ne}
V_{ne}: 130 kts.

Straight ahead	23.5	24.0
left turn – 30 degrees bank	23.5	23.75
right turn – 30 degrees bank	23.0	24.0

Longitudinal stick position approximately the same at V_{ne} with the Bear Paws installed and the Bear Paws not installed. No substantial increase in drag resulting in additional mast bending considerations.

Observations:

- adequate control margins were observed at each of the above listed flight speeds.
- positive longitudinal stability was observed at each flight speed.
- there was no visual indication of vibration of either the bear paws or the landing gear assembly.

Climb Flight

- steady climb 65 kts
Manifold pressure: 23 "Hg

straight ahead	22.0	26.5
left turn – 30 degrees bank - neutral pedal	22.5	26.25
right turn – 30 degrees bank - neutral pedal	22.5	26.0

- steady climb 65 kts
Manifold pressure: 18.5 "Hg
straight ahead

left turn – 30 degrees bank - neutral pedal	22.0	26.0
right turn – 30 degrees bank - neutral pedal	22.0	27.0

Maximum Continuous Power, 55 kts (V_y)

Compass heading: 080°
Start Altitude: 1,400 ft. ASL
End Altitude: 2,400 ft. ASL
Start time: :25
End time: :15
Elapsed time to climb: 0 min 50 seconds
Calculated rate of climb: 1,200 ft./min.

55 kts, MCP

Compass heading: 260°
Start Altitude: 1,250 ft. ASL
End Altitude: 2,250 ft. ASL
Start time: :30
End time: 1:15
Elapsed time to climb: 0 min 45 seconds
Calculated rate of climb: 1,333 ft./min.

Observations:

- adequate control margins were observed at each of the above listed flight conditions.
- positive longitudinal stability was observed at each flight speed.
- there was no visual indication of vibration of either the bear paws or the landing gear assembly.

Flight Demonstration Speed

-cruise Max continuous power
Alt: 1,800 ft. ASL descending to achieve V_d
V_d: 113 kts. achieved
straight ahead
left turn – 30 degrees bank demonstrated
right turn – 30 degrees bank demonstrated

Autorotation

Entry speed: 60 kts
Entry altitude: 1,600 ft. ASL

Entry characteristics acceptable
Descent flight characteristics acceptable

Entry speed: 88 kts
Entry altitude: 1,950 ft. ASL

Entry characteristics acceptable
Descent flight characteristics acceptable

Take off and Landing

Helicopter made an "off-field" landing in a wet grassy field with 2-3 inches of standing water to demonstrate landing and take off characteristics under these conditions with Bear Paws installed. Top of skid approximately 2 inches underwater.

No unusual or difficult handling characteristics were observed.

General Notes:

Stick pressures remained positive throughout all flights.

No unusual flight characteristics were observed.

Stick position measurements: Stick position laterally and longitudinally measured by small, light tape measures secured to the aircraft structure and the loose end of the tape secured to the stick. The measurements are arbitrary and can only be used for comparison purposes. The measurements taken between the central stick column and the LH door post for lateral position and between the central stick column and the instrument panel for the longitudinal position. The lateral measurement is taken such that an increasing number indicates stick moved to the right. The longitudinal measurement is taken such that an increasing number indicates stick moved aft.

Pilot: _____ Witness: _____

Ed Wilcock

Date: 02 February 2006

E. Burgoin

Date: 02 February, 2006

APPENDIX B

WEIGHT AND BALANCE CALCULATIONS

Weight and Balance for Flight Test 02 February 2006

Bear Paw Installation – Robinson R22

Robinson R22

C-FBXP, Serial No. 3730

Item	Weight (lbs.)	Arm (inches)	Moment (lb-in)
Basic Helicopter	883	103.23	91177
Bear Paw Installation	6	123.6	741
Pilot	190	78	14820
Passenger	210	78	16,380
Fuel			
Main - 1/2 full (108.6 lb. full)	54	115	6,245
Aux – ¼ full (103.8 full)	26	63	1,638
	1,369		131,002

C. G. = 131,002 / 1,369 = 95.64 inches

Gross Weight Limit: 1,370 lb.

Helicopter refueled between flights to specified fuel condition.

APPENDIX C

FAR 27 REQUIREMENTS

Sec. 27.65 – Climb: All engines operating.

(a) For rotorcraft other than helicopters--
(1) The steady rate of climb, at V_Y, must be determined--
(i) With maximum continuous power on each engine;
(ii) With the landing gear retracted; and
(iii) For the weights, altitudes, and temperatures for which certification is requested; and
(2) **[**The climb gradient, at the rate of climb determined in accordance with paragraph (a)(1) of this section, must be either--**]**
(i) At least 1:10 if the horizontal distance required to take off and climb over a 50-foot obstacle is determined for each weight, altitude, and temperature within the range for which certification is requested; or
(ii) **[**At least 1:6 under standard sea level conditions.**]**
(b) Each helicopter must meet the following requirements:
(1) V_Y must be determined--
(i) For standard sea level conditions;
(ii) At maximum weight; and
(iii) With maximum continuous power on each engine.
(2) **[**The steady rate of climb must be determined--
(i) At the climb speed selected by the applicant at or below V_{NE};
(ii) Within the range from sea level up to the maximum altitude for which certification is requested;
(iii) For the weights and temperatures that correspond to the altitude range set forth in paragraph (b)(2)(ii) of this section and for which certification is requested; and
(iv) With maximum continuous power on each engine.**]**

Sec. 27.141 – Flight Characteristics: General.

The rotorcraft must--
[(a) Except as specifically required in the applicable section meet the flight characteristics requirements of this subpart--
(1) At the altitudes and temperatures expected in operation;**]**
(2) Under any critical loading condition within the range of weights and centers of gravity for which certification is requested;
(3) For power-on operations, under any condition of speed, power, and rotor r.p.m. for which certification is requested; and
(4) For power-off operations, under any condition of speed and rotor r.p.m. for which certification is requested that is attainable with the controls rigged in accordance with the approved rigging instructions and tolerances;
(b) Be able to maintain any required flight condition and make a smooth transition from any flight condition to any other flight condition without exceptional piloting skill, alertness, or strength, and without danger of exceeding the limit load factor under any operating condition probable for the type, including--
(1) Sudden failure of one engine, for multiengine rotorcraft meeting Transport Category A engine isolation requirements of Part 29 of this chapter; and
(2) Sudden, complete power failure, for other rotorcraft; and
(3) Sudden, complete control system failures specified in Sec. 27.695 of this Part; and
(c) Have any additional characteristic required for night or instrument operation, if certification for those kinds of operation is requested. Requirements for helicopter instrument flight are contained in Appendix B of this Part.

Sec. 27.143 – Controllability and maneuverability.

(a) The rotorcraft must be safely controllable and maneuverable--
(1) During steady flight; and
(2) During any maneuver appropriate to the type, including--
(i) Takeoff;
(ii) Climb;
(iii) Level flight;
(iv) Turning flight;
(v) Glide;
(vi) Landing (power on and power off); and
(vii) Recovery to power-on flight from a balked autorotative approach.
(b) The margin of cyclic control must allow satisfactory roll and pitch control at V_{NE} with--
(1) Critical weight;
(2) Critical center of gravity;
(3) Critical rotor r.p.m.; and
(4) Power off (except for helicopters demonstrating compliance with paragraph (e) of this section) and power on.
(c) A wind velocity of not less than 17 knots must be established in which the rotorcraft can be operated without loss of control on or near the ground in any maneuver appropriate to the type (such as crosswind takeoffs, sideward flight, and rearward flight), with--
(1) Critical weight;
[(2) Critical center of gravity;
(3) Critical rotor r.p.m.; and
(4) Altitude, from standard sea level conditions to the maximum altitude capability of the rotorcraft or 7,000 feet, whichever is less.**]**
(d) The rotorcraft, after (1) failure of one engine in the case of multiengine rotorcraft that meet Transport Category A engine isolation requirements, or (2) complete engine failure in the case of other rotorcraft, must be controllable over the range of speeds and altitudes for which certification is requested when such power failure occurs with maximum continuous power and critical weight. No corrective action time delay for any condition following power failure may be less than--
(i) For the cruise condition, one second, or normal pilot reaction time (whichever is greater); and
(ii) For any other condition, normal pilot reaction time.
(e) For helicopters for which a V_{NE} (power-off) is established under Sec. 27.1505(c), compliance must be demonstrated with the following requirements with critical weight, critical center of gravity, and critical rotor r.p.m.:
(1) The helicopter must be safely slowed to V_{NE} (power-off), without exceptional pilot skill, after the last operating engine is made inoperative at power-on V_{NE}.
(2) At a speed of 1.1 V_{NE} (power-off), the margin of cyclic control must allow satisfactory roll and pitch control with power off.

Sec. 27.171 – Stability: General

The rotorcraft must be able to be flown, without undue pilot fatigue or strain, in any normal maneuver for a period of time as long as that expected in normal operation. At least three landings and takeoffs must be made during this demonstration.

Sec. 27.173 – Static longitudinal stability.

[(a) The longitudinal control must be designed so that a rearward movement of the control is necessary to obtain a speed less than the trim speed, and a forward movement of the control is necessary to obtain a speed more than the trim speed.
(b) With the throttle and collective pitch held constant during the maneuvers specified in Sec. 27.175(a) through (c), the slope of the control position versus speed curve must be positive throughout the full range of altitude for which certification is requested.
(c) During the maneuver specified in Sec. 27.175(d), the longitudinal control position versus speed curve may have a negative slope within the specified speed range if the negative motion is not greater than 10 percent of total control travel.]

Sec. 27.175 – Demonstration of static longitudinal stability.

(a) *Climb.* Static longitudinal stability must be shown in the climb condition at speeds from 0.85 V_Y to 1.2 V_Y, with--
(1) Critical weight;
(2) Critical center of gravity;
(3) Maximum continuous power;
(4) The landing gear retracted; and
(5) The rotorcraft trimmed at V_Y.
(b) *Cruise.* Static longitudinal stability must be shown in the cruise condition at speeds from 0.7 V_H or 0.7 V_{NE}, whichever is less, to 1.1 V_H or 1.1 V_{NE}, whichever is less, with--
(1) Critical weight;
(2) Critical center of gravity;
(3) Power for level flight at 0.9 V_H or 0.9 V_{NE}, whichever is less;
(4) The landing gear retracted; and
(5) [The rotorcraft trimmed at 0.9 V_H or 0.9 V_{NE}, whichever is less.]
(c) *Autorotation.* Static longitudinal stability must be shown in autorotation at airspeeds from 0.5 times the speed for minimum rate of descent to V_{NE} or to 1.1 V_{NE} (power-off) if V_{NE} (power-off) is established under Sec. 27.1505(c), and with--
(1) Critical weight;
(2) Critical center of gravity;
(3) Power off;
(4) The landing gear--
(i) Retracted; and
(ii) Extended; and
(5) The rotorcraft trimmed at appropriate speeds found necessary by the Administrator to demonstrate stability throughout the prescribed speed range.
(d) *Hovering.* For helicopters, the longitudinal cyclic control must operate with the sense and direction of motion prescribed in Sec. 27.173 between the maximum approved rearward speed and a forward speed of 17 knots with--
(1) Critical weight;
(2) Critical center of gravity;
(3) Power required to maintain an approximate constant height in ground effect;
(4) The landing gear extended; and
(5) The helicopter trimmed for hovering.

Sec. 27.177 – Static directional stability.

[Static directional stability must be positive with throttle and collective controls held constant at the trim conditions specified in Sec. 27.175 (a) and (b). This must be shown by steadily increasing directional control deflection for sideslip angles up to $\pm 10°$ from trim. Sufficient cues must accompany sideslip to alert the pilot when approaching sideslip limits.]

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13 February 2006

E & B Helicopters Ltd.
P.O. Box 1000
Campbell River, BC
V9W 6Y4

Attn: Ed Wilcock

Re: R22 and R44 Flight Tests

Ed:

Please find attached the following documents related to this project:

Robinson R22 Flight Test Report
Robinson R44 Flight Test Report

Could you please sign both reports in the indicated position on the last page and return to me.

Documents have been submitted to Transport Canada but the flight test person responsible for signing off on this is away until the beginning of next week. Hopefully things will move along quickly when he returns.

Regards,

Edward Burgoin

Encl.

Aircraft: C-FBXP
Robinson R22, Serial no. 3730

02 February 2006
Location: Campbell River BC

Configuration: 1370 lbs. at take-off (max. gross weight for V_{ne} at 102 KIAS.)
CG at 95.64 (limited by fuel and occupant location – no additional ballast)
Bear Paws not installed.
No other external modifications installed on the aircraft.

Crew: Pilot: Ed Wilcock, E & B Helicopters
DAR: Ted Burgoin, Aero Design Ltd.

Base Line Flight without either: BearPaws installed
Right Skid Tube Mirror

Low Speed Controllability	Cyclic Stick Tape Position Lateral	Long.
- stationery hover	21.25	29.75
- sideward flight to 20 mph to right	22.0	29.5
- sideward flight to 20 mph to left	20.75	29.5
- backward flight to 20 mph	21.5	30.25

Observations:

a) adequate control margins were maintained.

Forward Flight

- cruise	60 kts -- Manifold Pressure	16.8 "Hg	
	straight ahead	22.0	26.5
	left turn – 30 degrees bank	23.0	26.75
	right turn – 30 degrees bank	22.5	26.5
- cruise	70 kts -- Manifold Pressure	16.8 "Hg	
	Straight ahead	23.0	26.25
	left turn – 30 degrees bank	22.5	26.5
	right turn – 30 degrees bank	23.0	26.5
- cruise	80 kts -- Manifold Pressure	18.0 "Hg	
	Straight ahead	23.0	26.0
	left turn – 30 degrees bank	23.0	25.75
	right turn – 30 degrees bank	23.0	26.0
- cruise	90 kts -- Manifold Pressure	20.5 "Hg	
	Straight ahead	23.0	25.0
	left turn – 30 degrees bank	23.25	25.0
	right turn – 30 degrees bank	23.25	25.0

- cruise	Max continuous power -- Manifold Pressure	24.0 "Hg	
	Alt: 1,000 ft. ASL		
	V_h: 95 kts.		
	Straight ahead	23.5	24.25
	left turn – 30 degrees bank	23.5	24.25
	right turn – 30 degrees bank	24.0	24.0
-cruise	Max continuous power		
	Alt: 1,500 ft. ASL descending to achieve V_{ne}		
	V_{ne}: 102 kts.		
	Straight ahead	23.5	24.0
	left turn – 30 degrees bank	23.5	23.75
	right turn – 30 degrees bank	23.0	24.0

Observations:

- adequate control margins were observed at each of the above listed flight speeds.
- positive longitudinal stability was observed at each flight speed.

Climb Flight

- steady climb	55 kts (V_y)		
	Manifold Pressure: 18 "Hg		
	straight ahead		
	left turn – 30 degrees bank	22.0	26.5
	right turn – 30 degrees bank	23.0	26.5

- Max Continuous Power 55 kts (V_y)			
	Manifold Pressure: 24 "Hg		
	straight ahead	21.75	27.0
	left turn – 30 degrees bank	23.5	26.5
	right turn – 30 degrees bank	23.25	26.5

Compass heading: 300°
Start Altitude: 800 ft. ASL
End Altitude: 1,800 ft. ASL
Start time: :50
End time: 1:37
Elapsed time to climb: 0 min 47 seconds
Calculated rate of climb: 1,277 ft./min.

Max Continuous Power 55 kts (V_y)

Compass heading: 120°
Start Altitude: 800 ft. ASL
End Altitude: 1,800 ft. ASL
Start time: :03
End time: 0:53
Elapsed time to climb: 0 min 50 seconds
Calculated rate of climb: 1,200 ft./min.

Observations:

- adequate control margins were observed at each of the above listed flight speeds.
- positive longitudinal stability was observed at each flight speed.

Autorotation

Entry speed: 65 kts
Entry altitude: 1,800 ft. ASL

Stick position during descent	23.0	28.0
Entry characteristics acceptable		
Descent flight characteristics acceptable		

Entry speed: 95 kts, then slowed down thru 85, 80, 70, 65 kts.
Entry altitude: 1,950 ft. ASL

Entry characteristics acceptable
Descent flight characteristics acceptable

Flight with Bear Paws Installed

Configuration: As in baseline flight except that the Bear Paws were installed, mirror not installed.

Low Speed Controllability	Cyclic Stick Tape Position Lateral	Long.
- stationery hover	21.5	29.5
- sideward flight to 20 mph to right- adequate pedal remaining	22.0	29.25
- sideward flight to 20 mph to left – adequate pedal remaining	20.5	29.0
- backward flight to 20 mph - neutral pedal	21.25	30.0

Observations:

- adequate control margins were maintained during each of the low speed flights.
- there was no visual indication of vibration of either the bear paws or the landing gear assembly.

Forward Flight

- cruise	60 kts		
	Manifold Pressure: 16.1 "Hg		
	straight ahead	23.0	27.0
	left turn – 30 degrees bank - neutral pedal	22.5	26.75
	right turn – 30 degrees bank - neutral pedal	22.75	26.75
- cruise	70 kts		
	Manifold Pressure: 16.0 "Hg		
	straight ahead	22.5	26.0
	left turn – 30 degrees bank - neutral pedal	22.25	26.0
	right turn – 30 degrees bank - neutral pedal	22.75	26.0
- cruise	80 kts		
	Manifold Pressure: 17.8 "Hg		
	Straight ahead	22.75	25.5
	left turn – 30 degrees bank - neutral pedal	22.75	26.25
	right turn – 30 degrees bank - neutral pedal	23.0	26.0
- cruise	90 kts		
	Straight ahead	23.25	25.0
	left turn – 30 degrees bank - neutral pedal	23.0	25.25
	right turn – 30 degrees bank - neutral pedal	23.5	25.0

- cruise Max. continuous power
Manifold pressure: 24.0,
Engine RPM: 100%
Vh: 95 KIAS

Straight ahead	22.5	26.0
left turn – 30 degrees bank - neutral pedal	22.5	25.25
right turn – 30 degrees bank - neutral pedal	23.25	26.0

-cruise Max continuous power
Alt: 1,800 ft. ASL descending to achieve V_{ne}
V_{ne}: 130 kts.

Straight ahead	23.5	24.0
left turn – 30 degrees bank - neutral pedal	23.5	24.0
right turn – 30 degrees bank - neutral pedal	23.5	24.25

From BASELINE flight (see previous):
Max continuous power
Alt: 1,200 ft. ASL descending to achieve V_{ne}
V_{ne}: 130 kts.

Straight ahead	23.5	24.0
left turn – 30 degrees bank	23.5	23.75
right turn – 30 degrees bank	23.0	24.0

Longitudinal stick position approximately the same at V_{ne} with the Bear Paws installed and the Bear Paws not installed. No substantial increase in drag resulting in additional mast bending considerations.

Observations:

- adequate control margins were observed at each of the above listed flight speeds.
- positive longitudinal stability was observed at each flight speed.
- there was no visual indication of vibration of either the bear paws or the landing gear assembly.

Climb Flight

- steady climb 65 kts
Manifold pressure: 23 "Hg

straight ahead	22.0	26.5
left turn – 30 degrees bank - neutral pedal	22.5	26.25
right turn – 30 degrees bank - neutral pedal	22.5	26.0

- steady climb 65 kts
Manifold pressure: 18.5 "Hg
straight ahead

left turn – 30 degrees bank - neutral pedal	22.0	26.0
right turn – 30 degrees bank - neutral pedal	22.0	27.0

Maximum Continuous Power, 55 kts (V_y)

Compass heading: 080°
Start Altitude: 1,400 ft. ASL
End Altitude: 2,400 ft. ASL
Start time: :25
End time: :15
Elapsed time to climb: 0 min 50 seconds
Calculated rate of climb: 1,200 ft./min.

55 kts, MCP

Compass heading: 260°
Start Altitude: 1,250 ft. ASL
End Altitude: 2,250 ft. ASL
Start time: :30
End time: 1:15
Elapsed time to climb: 0 min 45 seconds
Calculated rate of climb: 1,333 ft./min.

Observations:

- adequate control margins were observed at each of the above listed flight conditions.
- positive longitudinal stability was observed at each flight speed.
- there was no visual indication of vibration of either the bear paws or the landing gear assembly.

Flight Demonstration Speed

-cruise Max continuous power
Alt: 1,800 ft. ASL descending to achieve V_d
V_d: 113 kts. achieved
straight ahead
left turn – 30 degrees bank demonstrated
right turn – 30 degrees bank demonstrated

Autorotation

Entry speed: 60 kts
Entry altitude: 1,600 ft. ASL

Entry characteristics acceptable
Descent flight characteristics acceptable

Entry speed: 88 kts
Entry altitude: 1,950 ft. ASL

Entry characteristics acceptable
Descent flight characteristics acceptable

Take off and Landing

Helicopter made an "off-field" landing in a wet grassy field with 2-3 inches of standing water to demonstrate landing and take off characteristics under these conditions with Bear Paws installed. Top of skid approximately 2 inches underwater.

No unusual or difficult handling characteristics were observed.

Flight with Right Skid Tube Mounted Mirror Installed

Configuration: As in baseline flight except that the 6" diameter mirror was installed, bear paws not installed.

Low Speed Controllability	Cyclic Stick Tape Position Lateral	Long.
- stationery hover	21.5	29.75
- sideward flight to 20 mph to right- adequate pedal remaining	22.0	29.25
- sideward flight to 20 mph to left – adequate pedal remaining	21.0	29.25
- backward flight to 20 mph - neutral pedal	21.5	30.0

Observations:

- adequate control margins were maintained during each of the low speed flights.
- there was no visual indication of vibration of either the mirror or the landing gear assembly.

Forward Flight

- cruise	60 kts		
	Manifold Pressure: 16.3 "Hg		
	straight ahead	22.75	27.0
	left turn – 30 degrees bank - neutral pedal	22.75	26.5
	right turn – 30 degrees bank - neutral pedal	22.75	26.75
- cruise	70 kts		
	Manifold Pressure: 16.5 "Hg		
	straight ahead	22.5	26.25
	left turn – 30 degrees bank - neutral pedal	22.5	26.5
	right turn – 30 degrees bank - neutral pedal	22.75	26.25
- cruise	80 kts		
	Manifold Pressure: 18.0 "Hg		
	Straight ahead	22.75	25.5
	left turn – 30 degrees bank - neutral pedal	23.0	26.0
	right turn – 30 degrees bank - neutral pedal	23.25	26.0
- cruise	90 kts		
	Manifold Pressure: 20.8 "Hg		
	Straight ahead	23.25	25.25
	left turn – 30 degrees bank - neutral pedal	23.0	25.25
	right turn – 30 degrees bank - neutral pedal	23.5	25.5

- cruise Max. continuous power
Manifold pressure: 24.0,
Engine RPM: 100%
V_h: 94 KIAS

Straight ahead	22.75	26.0
left turn – 30 degrees bank - neutral pedal	22.75	25.5
right turn – 30 degrees bank - neutral pedal	23.25	26.25

-cruise Max continuous power
Alt: 1,800 ft. ASL descending to achieve V_{ne}
V_{ne}: 130 kts.

Straight ahead	23.0	24.0
left turn – 30 degrees bank - neutral pedal	23.5	23.75
right turn – 30 degrees bank - neutral pedal	23.5	24.25

From BASELINE flight (see previous):
Max continuous power
Alt: 1,200 ft. ASL descending to achieve V_{ne}
V_{ne}: 130 kts.

Straight ahead	23.5	24.0
left turn – 30 degrees bank	23.5	23.75
right turn – 30 degrees bank	23.0	24.0

Longitudinal stick position approximately the same at V_{ne} with the Mirror installed and the Mirror not installed. No substantial increase in drag resulting in additional mast bending considerations.

Observations:

- adequate control margins were observed at each of the above listed flight speeds.
- positive longitudinal stability was observed at each flight speed.
- there was no visual indication of vibration of either the mirror or the landing gear assembly.

Climb Flight

Maximum Continuous Power, 55 kts (V_y)

Compass heading: 030°
Start Altitude: 900 ft. ASL
End Altitude: 1,900ft. ASL
Start time: :45
End time: :35
Elapsed time to climb: 0 min 50 seconds
Calculated rate of climb: 1,200 ft./min.

Maximum Continuous Power, 55 kts (V_y)

Compass heading: 210°
Start Altitude: 850 ft. ASL
End Altitude: 1,850 ft. ASL
Start time: :25
End time: 1:17
Elapsed time to climb: 0 min 52 seconds
Calculated rate of climb: 1,154 ft./min.

Observations:

- adequate control margins were observed at each of the above listed flight speeds.
- positive longitudinal stability was observed at each flight speed.
- there was no visual indication of vibration of either the mirror or the landing gear assembly.

Flight Demonstration Speed

-cruise Max continuous power
Alt: 2,000 ft. ASL descending to achieve V_d
V_d: 115 kts. achieved
straight ahead
left turn – 30 degrees bank demonstrated
right turn – 30 degrees bank demonstrated
there was no visual indication of vibration of either the mirror or the landing gear assembly.

Autorotation

Entry speed: 60 kts
Entry altitude: 1,500ft. ASL

Entry characteristics acceptable
Descent flight characteristics acceptable
there was no visual indication of vibration of either the mirror or the landing gear assembly.

Entry speed: 95 kts
Entry altitude: 1,400 ft. ASL

Entry characteristics acceptable
Descent flight characteristics acceptable
there was no visual indication of vibration of either the mirror or the landing gear assembly.

General Notes:

Stick pressures remained positive throughout all flights.

No unusual flight characteristics were observed.

Stick position measurements: Stick position laterally and longitudinally measured by small, light tape measures secured to the aircraft structure and the loose end of the tape secured to the stick. The measurements are arbitrary and can only be used for comparison purposes. The measurements taken between the central stick column and the LH door post for lateral position and between the central stick column and the instrument panel for the longitudinal position. The lateral measurement is taken such that an increasing number indicates stick moved to the right. The longitudinal measurement is taken such that an increasing number indicates stick moved aft.

Pilot: 

Ed Wilcock

Date: 02 February 2006

Witness: 

E. Burgoin

Date: 02 February 2006

AERO Design Ltd.

ENGINEERING REPORT
ER640.02

BEAR PAWS INSTALLATION

Robinson R22

Approved: E. Burgoin, P. Eng.

Prepared by: Jeff Clarke

Revision 0
Date: 16 January, 2006

AERO Design Ltd.
Engineering Consultants

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TABLE OF CONTENTS

1.0 INTRODUCTION

"Bear paws" are pads installed on the skid tube in order to distribute the weight of the helicopter when landing on soft surfaces, such as snow. The pads in this installation are made of aluminum sheet, and are attached to using bolts where the aft cross tube joins the skid tube, and to the aft end of the skid tube.

2.0 REFERENCE

AERO Design Ltd. Drawing 64002

MIL-HDBK-5J

Memo from John Shapley of FAA, Regarding Bear Paw requirements

3.0 BASIS OF CERTIFICATION

Robinson R22, R22 Alpha, R22 Beta, R22 Mariner, TCDS H10WE

FAR 27, dated February 1, 1965, including amendments 27-1 thru 27-10.

This installation:

FAR 27, dated February 1, 1965, including amendments 27-1 thru 27-24.

(Basis of certification of R44)

4.0 ANALYSIS OF CURRENT AIRWORTHINESS DIRECTIVES (AD'S)

There are no current AD's related to this project. See appendix A for a list of current AD's.

5.0 LOADS

The bear paw is made from 1/8" 6061-T6 Aluminum sheet. Using the memo from John Shapley of the FAA the following assumptions can be made:
a) 1g (limit) static loading at maximum gross weight and critical C of G.
b) assume equal load dstribution between the pads.
c) metallic pads are considered rigid, and a rectangular load distribution can be assumed.

$GW_{max} := 1370 \cdot lbf$ $CG_{aft\_max} := 100 \cdot in$ Max Gross weight and aft C of G limit

$FS_{cp} := 124.1 \cdot in$ Flight station of centre of pressure of pad

$FS_{fwd\_tip} := 43 \cdot in$ Flight station of forward edge of skid tube in contact with ground

$FS_{aft\_tip} := 130 \cdot in$ Flight station of aft edge of skid tube

The load is equally distributed between the left and right sides.

$D_{tube} := 2.0 \cdot in$ Diameter of skid tube

$A_{tube} := \left(FS_{aft\_tip} - FS_{fwd\_tip}\right) \cdot D_{tube}$

$A_{tube} = 174 \cdot in^2$ Planar area of skid tube

$A_{paw} := 156 \cdot in^2$ Planar area of entire bear paw

Assumptions:
a) Forward tip of the skid tube is rigidly supported (sitting on a solid object, eg. a rock or log)
b) Remainder of skid tube is supported on non-solid "swampy" material.
c) Ground reactions:
-point load at forward end of skid tube
-triangular load distribution over remainder of skid tube
-rectangular load distribution over bear paw, equal to max. distributed load on skid tube

Summing moments about the forward tip for one (1) skid tube:

$$w_{max} := \frac{\frac{GW_{max}}{2} \cdot \left(CG_{aft\_max} - FS_{fwd\_tip}\right)}{0.5 \cdot A_{tube} \cdot \frac{2}{3} \cdot \left(FS_{aft\_tip} - FS_{fwd\_tip}\right) + A_{paw} \cdot \left(FS_{cp} - FS_{fwd\_tip}\right)}$$

$w_{max} = 2.2 \cdot psi$ Maximum pressure

w_{max} is the maximum pressure for the triangular distribution on the skid tube, and the uniform pressure on the bear paw.

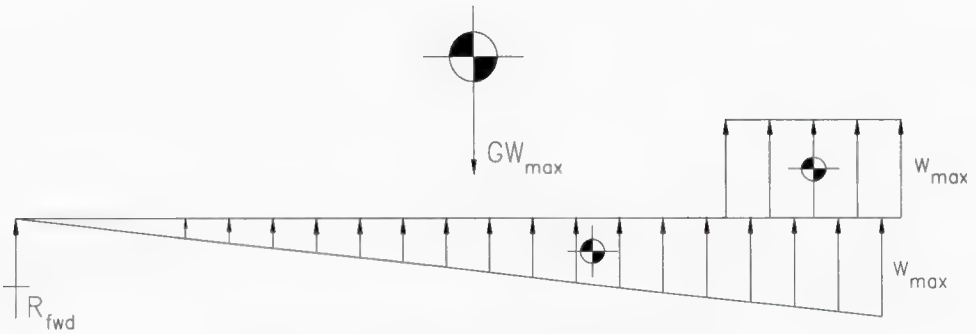


Figure 1 – Skid tube load distribution

Load on Bear Paws

$p_{paw} := w_{max} \cdot A_{paw}$

$p_{paw} = 344 \cdot lbf$ Load on paw

$p_{paw\_side} := \frac{p_{paw}}{2}$

$p_{paw\_side} = 172 \cdot lbf$ Load on each half of paw

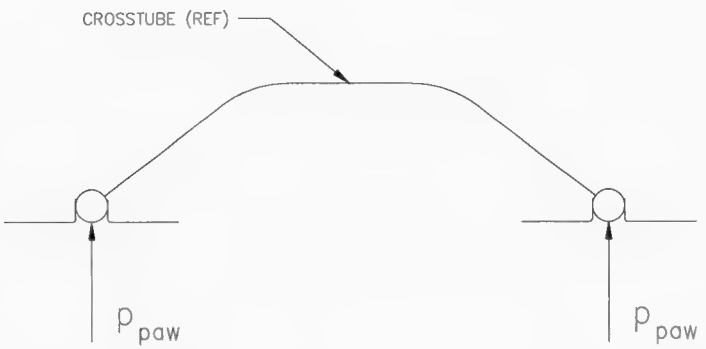


Figure 2 – Load Reactions

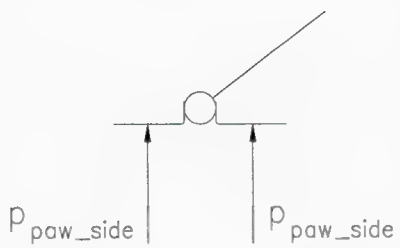


Figure 3 – Paw loads

6.0 STRUCTURAL COMPLIANCE

Determine the bending moment allowable of attachments, using Bruhn, chapter C3:

1) Bending on aft strap

Locate neutral axis

Assume 1" of effective paw material on either side of strap. Strap is 3/4" x 1/4".

$$y_{na} := \frac{2.75 \cdot in \cdot 0.125 \cdot in \cdot 0.0625 \cdot in + 0.75 \cdot in \cdot 0.25 \cdot in \cdot 0.25 \cdot in}{2.75 \cdot in \cdot 0.125 \cdot in + 0.75 \cdot in \cdot 0.25 \cdot in}$$

$y_{na} = 0.129 \cdot in$ Distance from bottom of sheet to neutral axis

Since the neutral axis is so close to the thickness of the sheet, the neutral axis is assumed to be located at the top edge of the sheet.

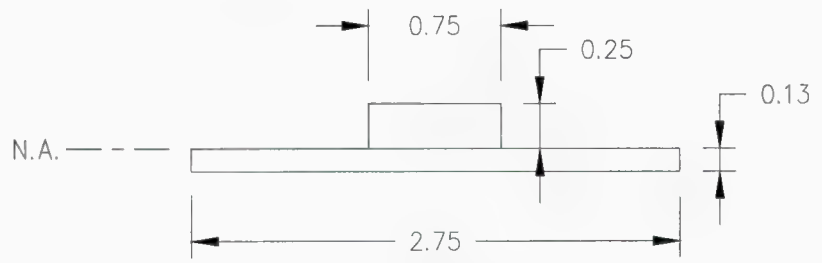


Figure 4 – Strap Section

$$I_1 := \frac{1}{12} \cdot 0.75 \cdot in \cdot (0.5 \cdot in)^3$$

$I_1 = 0.007813 \cdot in^4$ Moment of inertia of strap

$C_1 := 0.25 \cdot in$ Distance from centroid to outer edge

$F_{ty} := 36 \cdot ksi$ Yield tensile strength of 6061-T6 Aluminum (ref: MIL-HDBK-5J)

$$M_1 := \frac{F_{ty} \cdot \frac{I_1}{C_1}}{2}$$

$M_1 = 562.5 \cdot in \cdot lbf$ Allowable bending moment on strap

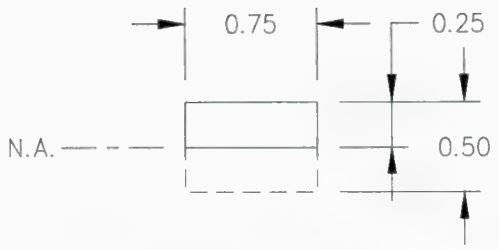


Figure 5 – Top Section of Strap

$$I_2 := \frac{1}{12} \cdot 2.75 \cdot in \cdot (0.25 \cdot in)^3$$

$I_2 = 0.003581 \cdot in^4$ Moment of inertia of effective sheet

$C_2 := 0.125 \cdot in$ Distance from centroid to outer edge

$$M_2 := \frac{F_{ty} \cdot \frac{I_2}{C_2}}{2}$$

$M_2 = 515.6 \cdot in \cdot lbf$ Allowable bending moment on effective sheet

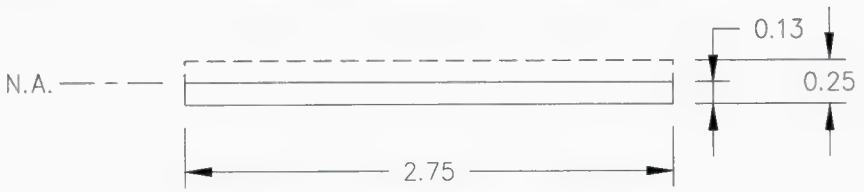


Figure 6 – Bottom Section of Strap

$M_{a\_strap} := M_1 + M_2$

$M_{a\_strap} = 1078 \cdot in \cdot lbf$ Allowable bending moment on strap/sheet section

In order for the moments to be added, there must be sufficient rivets to transfer shear into the strap.

$Q := 0.75 \cdot in \cdot 0.25 \cdot in \cdot 0.125 \cdot in$

$Q = 0.023 \cdot in^3$ First moment of area of section above joint

$$I = \sum I_c + Ay^2$$

$$I := \left[\frac{1}{12} \cdot 0.75 \cdot in \cdot (0.25 \cdot in)^3\right] + (0.75 \cdot in \cdot 0.25 \cdot in) \cdot (0.125 \cdot in)^2 + \left[\frac{1}{12} \cdot 2.75 \cdot in \cdot (0.125 \cdot in)^3\right] + (2.75 \cdot in \cdot 0.125 \cdot in) \cdot (0.0625 \cdot in)^2$$

$I = 0.0057 \cdot in^4$ Moment of inertia of section

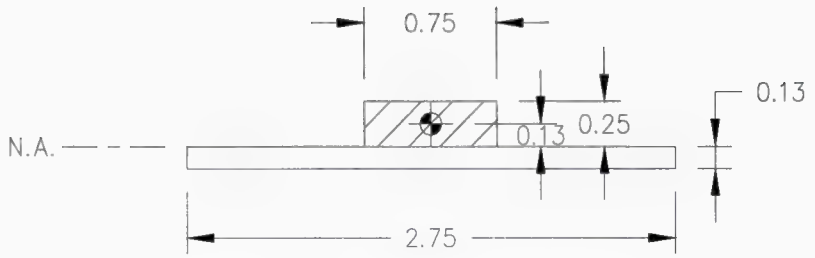


Figure 7 – Area Above Neutral Axis

The strap is attached to the paw with MS20426AD5 rivets. The rivet pitch is 1.0".

$$q := \frac{596 \cdot lbf}{1.0 \cdot in}$$

$q = 596 \cdot \frac{lbf}{in}$ Allowable running load on rivets

$$V_{allow} := \frac{q \cdot I}{Q}$$

$V_{allow} = 145 \cdot lbf$ Allowable shear on strap

Assuming half of the load on the paw is distributed to the strap, and the other half to the forward attachments:

$$V_{strap} := \frac{P_{paw\_side}}{2}$$

$V_{strap} = 86 \cdot lbf$ Shear applied to strap

$V_{allow} = 145 \cdot lbf$ Allowable shear

Margin of Safety $MS := \frac{V_{allow}}{V_{strap}} - 1$

$MS = 0.7$

MARGIN OF SAFETY IS POSITIVE

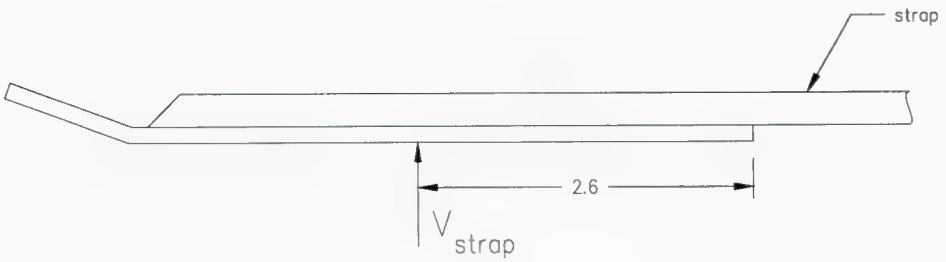


Figure 8 – Bending on Strap

$M_{strap} := V_{strap} \cdot 2.6 \cdot in$

$M_{strap} = 224 \cdot in \cdot lbf$ Bending moment on strap
(centre of pressure is 2.6" from inside edge of paw at the strap)

$M_{a\_strap} = 1078 \cdot in \cdot lbf$ Allowable bending moment on strap

Margin of Safety $MS := \frac{M_{a\_strap}}{M_{strap}} - 1$

$MS = 3.8$

MARGIN OF SAFETY IS POSITIVE

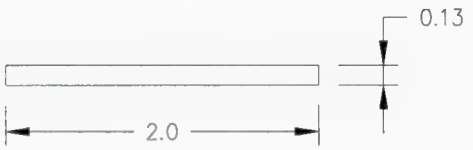


Figure 9 – Section at Bolt Attachment

2) Bending at bolt attachments

Assuming a 2" effective width of sheet at each bolt:

$I := \frac{1}{12} \cdot 2 \cdot in \cdot (0.125 \cdot in)^3$

$I = 0.000326 \cdot in^4$ Moment of inertia of effective width

$C := 0.0625 \cdot in$ Distance from centroid to outer edge

$M_{allow} := 2 \cdot F_{ty} \cdot \frac{I}{C}$

$M_{allow} = 375 \cdot in \cdot lbf$ Allowable bending moment on forward bolted attachments
(2 attachments)

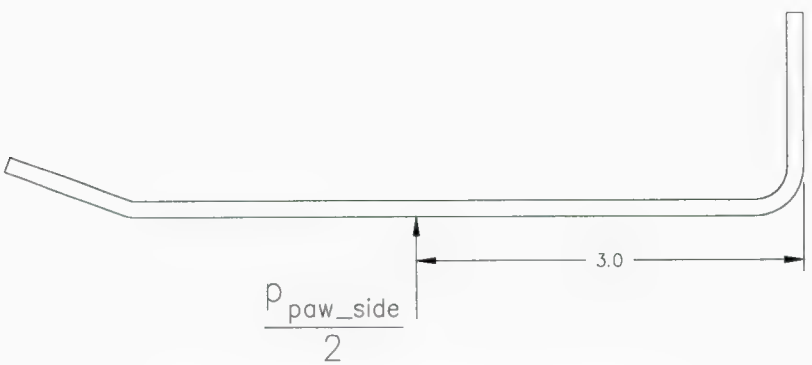


Figure 10 – Bending at Bolt Attachments

Assuming half the load is applied to the forward attachments:

$$M := \frac{p_{paw\_side}}{2} \cdot 3 \cdot in$$

$M = 258 \cdot in \cdot lbf$ Applied bending moment to forward attachments

Margin of Safety $MS := \frac{M_{allow}}{M} - 1$

$MS = 0.45$

MARGIN OF SAFETY IS POSITIVE

Note that the yield tensile strength has been used to ensure that the applied static load does not permanently deform the bear paw installation.

Attachment Bolts

The bear paws are attached to the landing gear with two (2) AN4 bolts at the forward end.

Assuming all of the load applied to the bear paw is resisted by one bolt:

$p_{paw\_side} = 172 \cdot lbf$ Load on bear paw (each side of skid tube)

$p_{s\_bolt} := p_{paw\_side}$

$p_{s\_bolt} = 172 \cdot lbf$ Shear on bolt

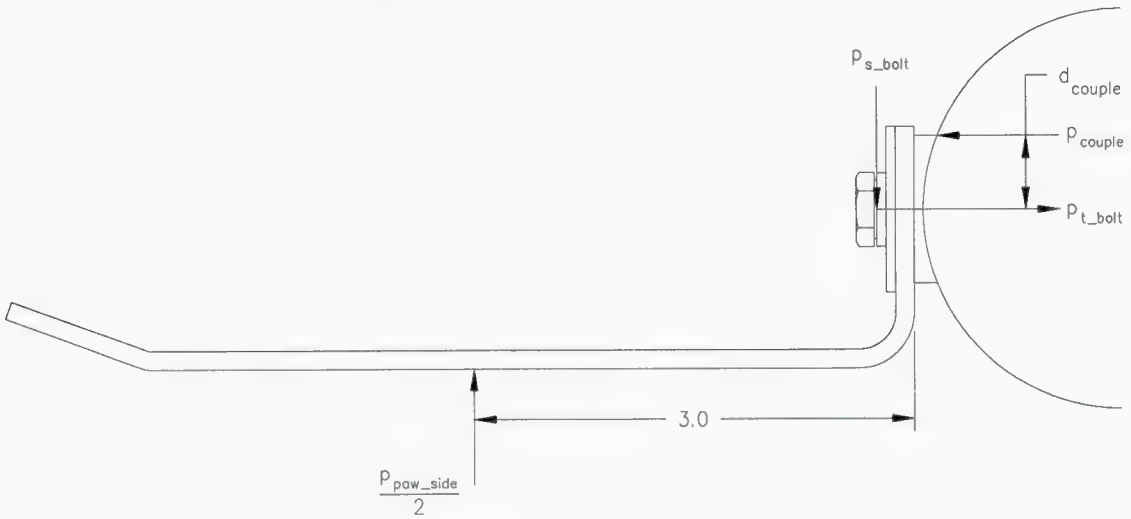


Figure 11 – Load on Bolts

The bending moment from the applied load acts as a couple with tension on the bolt, and compression on the upper side of the spacer.

$d_{couple} := 0.5 \cdot in$ Distance from centre of bolt to edge of spacer

$M_{couple} := p_{paw\_side} \cdot 3 \cdot in$

$M_{couple} = 516 \cdot in \cdot lbf$ Moment from applied load to attachment bolt

$$p_{couple} := \frac{M_{couple}}{d_{couple}}$$

$p_{couple} = 1033 \cdot lbf$ Couple load (tension on bolt, compression on top edge of spacer)

$p_{t\_bolt} := p_{couple}$

$p_{t\_bolt} = 1033 \cdot lbf$ Tension on bolt

Using Bruhn, Chapter D1, the margin of safety for the bolt in combined tension and shear can be found.

$P_{t\_allow} := 4170 \cdot lbf$ Allowable tension on bolt (using Fig D1.4 in Bruhn)

Margin of Safety $MS := \frac{P_{t\_allow}}{p_{t\_bolt}} - 1$

$MS = 3$

MARGIN OF SAFETY IS POSITIVE

7.0 ALLOWABLE GOUGE/SCRATCH DEPTH

The critical section in bending is at the corner where the paw is flanged up to the attachment bolts. Assuming the entire length is effective in bending, and that the ultimate strength of the material is used, the allowable gouge depth can be determined by reducing the section until the margin of safety reaches 0.

Total length of flange is 6.8".

$t := 0.075 \cdot in$ Thickness at gouged section

$$I := \frac{1}{12} \cdot 6.8 \cdot in \cdot (t)^3$$

$I = 0.000239 \cdot in^4$ Moment of inertia of effective width

$$C := \frac{t}{2}$$ Distance from centroid to outer edge

$F_{tu} := 42 \cdot ksi$ Ultimate tensile strength of 6061-T6 aluminum (Ref: MIL-HDBK-5J)

$M_{allow} := F_{tu} \cdot \frac{I}{C}$

$M_{allow} = 268 \cdot in \cdot lbf$ Allowable bending moment on forward bolted attachments (2 attachments)

Assuming half the load is applied to the forward attachments:

$M := \frac{P_{paw\_side}}{2} \cdot 3 \cdot in$

$M = 258 \cdot in \cdot lbf$ Applied bending moment to forward attachments

Margin of Safety $MS := \frac{M_{allow}}{M} - 1$

$MS = 0.04$

MARGIN OF SAFETY IS POSITIVE

$d_{gouge} := 0.125 \cdot in - t$

$d_{gouge} = 0.05 \cdot in$ Depth of gouge

The paw will not fail with a gouge depth of 0.050" in the static loading conditions.

APPENDIX A

CURRENT AD'S

All airworthiness directives applicable to:
Manufacturer: ROBINSON
Model: R22 MARINER (all apply to R22 and R22 Beta)

AD Record List

New	Model	Ctry.	AD Number		AD Subject	Service Bulletin or Reference	Repeat Insp.?
	R22 MARINER	CF	CF-98-15		EXTERNAL RESCUE SYSTEMS	CAR 702.21	YES
	R22 MARINER	CF	CF-96-08		CHANGES TO AIRCRAFT FLIGHT MANUAL	AFM INSERTIONS	YES
	R22 MARINER	US	2005-16-05		Visually inspect each pilot and copilot door assembly integral frame for a cracks.	TECH-TOOL STC SR09189RC	REFER TO AD
	R22 MARINER	US	2004-19-09		MAIN ROTOR BLADE FATIGUE CRACKS	AWL	REFER TO AD
	R22 MARINER	US	2004-06-52		R22-ALPHA,BETA,MARINER - MAIN ROTOR BLADE FAILURE		REFER TO AD
	R22 MARINER	US	2003-04-04		R22 SERIES - TAIL ROTOR PITCH CHANGE BEARING	SB-90 REV A	REFER TO AD
	R22 MARINER	US	2000-20-51		YOKE HALF ASSEMBLY INSPECTION	88A	REFER TO AD
	R22 MARINER	US	2000-08-09		SPRAG CLUTCH	85	REFER TO AD
	R22 MARINER	US	99-07-17		SPRAG CLUTCH ASSEMBLY	85	REFER TO AD
	R22 MARINER	US	99-02-02		FLEXPLATE FAILURE (SUPERSEDES 95-06-07 98-14-08)	75	REFER TO AD
	R22 MARINER	US	98-21-09		FUEL TANK VENTS	SB-83	REFER TO AD
	R22 MARINER	US	97-25-05		MIXTURE CONTROL IDLE CUTOFF	SB 82	REFER TO AD
	R22 MARINER	US	97-02-14		PILOT MISMANAGEMENT OF ROTOR RPM	SUPERCEDES 96-11-08	REFER TO AD
	R22 MARINER	US	96-09-29		V BELT SHEAVE P/N A170-1I OR J OR A170 -2J	SB-77	REFER TO AD
	R22 MARINER	US	95-23-05		TAIL ROTOR OUTPUT KEY (SUPERSEDES AD 94-17-07)		REFER TO AD
	R22 MARINER	US	95-11-09		PLACARD AGAINST LOW G CYCLIC PUSHOVER	SB-79	REFER TO AD
	R22 MARINER	US	95-06-03		MAIN ROTOR MAST SEPARATION-SPANNER NUTS		REFER TO AD
	R22 MARINER	US	94-15-08		MAIN ROTOR BLADE INSPECTION	72	REFER TO AD
	R22 MARINER	US	92-06-17		BOLT FAILURES P/N NAS1304-16 STAMPED `AF`	69	REFER TO AD
	R22 MARINER	US	90-17-01		CARB. AIRBOX LATCH REMOVAL	61	REFER TO AD
	R22 MARINER	US	88-26-01R2		A158-1 MAIN ROTOR SPINDLE + A106 JOURNAL	60 TECHNICAL REPORT	REFER TO AD
	R22 MARINER	US	87-18-03		MAIN ROTOR PITCH LINK ASSEMBLY		REFER TO AD
	R22 MARINER	US	84-18-04		MAIN ROTOR GEARBOX		REFER TO AD

R22 MARINER	US	83-15-07R1	MAIN ROTOR BLADE INSPECTION		REFER TO AD
R22 MARINER	US	82-15-07	TAIL ROTOR DRIVE SHAFT		REFER TO AD
R22 MARINER	US	82-11-01	STEEL TUBE FRAME	18	REFER TO AD
R22 MARINER	US	82-03-07	MAIN ROTOR BLADES		REFER TO AD
R22 MARINER	US	81-05-52R1	MAIN GEAR BOX	9	REFER TO AD
R22 MARINER	US	80-26-06	TAIL ROTOR PLATE	6 SL	REFER TO AD
R22 MARINER	US	80-24-01	TAILCONE	4	REFER TO AD
R22 MARINER	US	80-21-53	MAIN TRANSMISSION GEARS	5	REFER TO AD
R22 MARINER	US	80-11-07	MAIN ROTOR BLADES		REFER TO AD

APPENDIX B

MEMO FROM JOHN SHAPLEY

Department of Transportation
Federal Aviation Administration

Applicable Requirements for Helicopter Landing Gear "Bear Paw" Installations

Date FEB 2 1 1985

From John J. Shapley
Manager, Helicopter Policy and Procedures

Reply to Attn of Staff, ASW-110

To ANE-170

In response to your letter dated December 19, 1984, requesting guidance for approval of auxiliary skid pads such as "bear paws," we hereby provide the following comments:

I. Structural Considerations.

Auxiliary skid pads, such as "Bear Paws," etc., are considered to be secondary structure and need not be designed to the full landing gear loads of subpart C of FAR Parts 27 or 29. However, even as secondary structure, auxiliary skid pads should be evaluated for reliability, durability, and possible hazards to the aircraft in accordance with §§ 27/29.601, 27/29.603, and 27/29.605. Also the general strength requirements of § 27/29.301 through § 27/29.307 should be met.

The following procedures are considered to be conservative and adequate to show compliance of auxiliary skid pad installations in accordance with the previous policy statement.

1. Static Strength:

   (a) Ground Loads

      (1) Use 1g (limit) static load at maximum gross weight and critical center-of-gravity (c.g.) of the helicopter with respect to pad loads.

      (2) Assume equal load distribution between pads.

      (3) For flexible, non-metallic pads, assume triangular load distribution on each pad in the Y-Z plane with the peak load at the skid centerline.

      (4) For rigid pads, assume rectangular load distribution on each pad in the Y-Z plane.

(1) Use force coefficient, Cn = .55.

(2) Use Vne for calculating dynamic pressure, q.

(c) Substantiate by test and/or analysis.

2. Dynamic Loads

It should be verified that throughout the speed range from hover to Vne a resonant condition does not exist for the pads or the pad and skid landing gear combination. This should be accomplished by flight test using qualitative and/or quantitative measurements. Visual or auditory observations may be used to qualitatively verify that no resonance condition exists, or quantitative measurements using accelerometers may be obtained for verification.

3. Fatigue Substantiation of Skid Pads

Adequate fatigue substantiation can be provided by showing that the ground loads of Item 1 result in stresses which are below the endurance limit for the pad material and that the dynamic loads are low in accordance with Item 2 above.

4. Fatigue Substantiation of Original Landing Gear and Airframe (§ 27/29.971).

Verify by the flight tests of Item 2 above that no new airframe vibratory loads are introduced by the skid pads installation. If visual or auditory observations indicate significant new airframe vibratory loads may exist, instrumentation may be required to obtain quantitative vibratory data.

II. Flight Considerations

1. Performance

Unless the skid pads are very large in area, they should not have a significant effect on required helicopter performance (i.e., hover, takeoff, climb and landing). Thus performance measurements would not normally be required.

2. Flight Characteristics

Flight characteristics should be evaluated to verify that addition of the skid pads has not adversely affected controllability, manueverability, or stability (§§ 27/29.143 - 27/29.175).

(a) Controllability and Manueverability

A qualitative flight test evaluation should be conducted to compare the flight characteristics of the basic rotorcraft to the characteristics after the pad installation throughout the speed range from hover to Vne. If significant differences with the skid pads installed are noted by the test pilot, instrumentation should be installed to quantitatively verify that adequate control margins exist throughout the flight envelope.

(b) Stability

(1) Static

Quantitative static longitudinal stability should be obtained using a before and after comparison to verify that static stability has not been significantly affected by installation of the skid pads. The instrumentation required to conduct this test can be very simple since absolute control position is not required but only relative position with and without the pads. (A tape measurement of the distance between the cyclic control and a point on the instrument panel for example may be sufficient.) However, if significant differences are shown to exist, accurate instrumentation should be used to verify compliance with §§ 27/29.173 and 27/29.175.

(2) Dynamic

For helicopters certified for instrument flight, an assessment of the effect of skid pads on the dynamic stability should be made. For rotorcraft with required stability augmentation systems for IFR flight, the addition of skid pads should have little or no effect on the aircraft stability. The qualitative evaluation of Item 2(a) above will usually suffice to verify that dynamic stability characteristics have not been affected.

For rotorcraft which are IFR certified without stability augmentation systems results of the qualitative evaluation of step 2(a) and the quantitative evaluation of step 2(b)(1) above should be evaluated to determine if quantitative dynamic stability measurements are necessary. Generally if the test pilot finds no significant controllability differences and the static stability has not been affected, dynamic stability will not be affected. If a significant change in static stability is measured, dynamic stability should be closely evaluated if IFR certification of the skid pad configuration is desired.

Transport Canada / Transports Canada

SPECIAL FLIGHT PERMIT / PERMIS DE VOL SPÉCIAL

Name of Air Operator - Nom de l'exploitant aérien	Flight Permit Authorization No. - N° d'autorisation du permis de vol
E & B Helicopters Ltd.	1

Aircraft Manufacturer - Constructeur de l'aéronef	Model - Modèle	Serial No. - N° de série	Nationality and Registration Marks - Marques de nationalité et d'immatriculation
Robinson	R 22	3730	C-FBXP

Aircraft does not meet the applicable airworthiness requirements for the following reasons: / L'aéronef ne satisfait pas aux exigences de navigabilité en vigueur pour les raisons suivantes :

Installation of Bear Paws and Mirror that requires flight testing to complete design certification.

A ferry flight is authorized to a base where maintenance can be carried out according to the following itinerary: / Un vol de convoyage est autorisé à une base où des travaux d'entretien peuvent être exécutés, selon le trajet suivant :

From - De	To - À	Date (Y-A/M/D-J)
Campbell River	Local	2006-01-30

Intermediate stops (if any) - Escales intermédiaires, le cas échéant :

As required for flight testing for 90 days from issue.

Action to be taken prior to flight - Mesures à prendre avant le vol :

Logbook entry that installation is IAW Aero Design drawings 64002 and 64902 and the aircraft is safe for flight.

THIS FLIGHT SHALL BE SUBJECT TO THE FOLLOWING STANDARD OPERATING LIMITATIONS

1. Essential crew members only - No passengers.
2. Permission of foreign civil aviation authority required prior to flight over their territory.
3. Where, by virtue of damage or unserviceability, performance of the aircraft is in any way degraded, air traffic control is to be advised both in the flight plan and on initial contact.
4. Flight is limited to VMC ☑ Yes ☐ No

CE VOL EST SOUMIS AUX CONDITIONS D'EXPLOITATION NORMALISÉES SUIVANTES :

1. Membres d'équipage essentiels seulement - pas de passagers.
2. Obtenir l'autorisation des autorités de l'aviation civile étrangères avant d'effectuer un vol au-dessus de leur territoire.
3. Lorsque, en raison de dommages ou du mauvais état de l'aéronef, le rendement de ce dernier est d'une quelconque façon diminué, il faut en informer les services de contrôle de la circulation aérienne dans le plan de vol et au moment du contact initial.
4. Le vol est limité à VMC ☐ Oui ☐ Non

FLIGHT SHALL BE OPERATED IN COMPLIANCE WITH THE FOLLOWING SPECIAL OPERATING LIMITATIONS:

LE VOL DOIT ÊTRE RÉALISÉ CONFORMÉMENT AUX CONDITIONS D'EXPLOITATION PARTICULIÈRES SUIVANTES :

-No flight over built up areas.
-VNE 1.1 X VNE quoted in flight manual
-Flight is to follow flight test plan FTP 640.03 Rev 1 for Bear Paws and FTP 649.02 Rev _ for Cargo mirror.

PRINT NAME / REMPLIR EN CARACTÈRES D'IMPRIMERIE	
	Safe for ferry statement has been entered in the Journey Log by / L'attestation que l'aéronef est en état d'effectuer le vol de convoyage à été inscrite dans le carnet de route par ▶
	Flight under above limitations has been authorized by / Le vol en vertu des limites susmentionnées a été autorisé par ▶ Ted Bergoin/Greg Oucharek
	Form prepared by (if other than person signing below) / Formule établie par (si autre que le soussigné) ▶ N/A

Signature of Authorized Person - Signature de la personne autorisée	Date (Y-A/M/D-J)
John Ostensen	2006-01-30

TRANSPORT CANADA / TRANSPORTS CANADA — Civil Aviation Safety Inspector 0598 Canada

24-0027 (03/05-03)

1 ORIGINAL - FLIGHT LOG / CARNET DE VOL 2 OPERATOR'S RECORD / DOSSIER DE L'EXPLOITANT 3 TRANSPORT CANADA / TRANSPORTS CANADA

Canada

1 A/M/J	2 Pilot / Copilot Pilote / Copilote	3 From De	4 To À	5 Up Décollage	6 Down Atterrissage	7 Air time Temps-air	8 TTSN**	9	10
	Totals brought forward Totaux reportés						712.4		
DEC 29/05	SEE DAILY F.S.	CCR6	CCR6	1100	1500	3.2	715.5		
DEC 30/05	SEE DAILY F.S	CCR6	CCR6	1100	1500	2.2	717.7		
JAN 03/06	SEE DAILY FS					5.8	723.5		
JAN 04/06	SEE DAILY FS					3.2	726.7		
JAN 5 2006	SEE DAILY F.S					3.6	730.3		
JAN 6 2006	SEE DAILY F.S					2.4	732.7		
JAN 15 2006	SEE DAILY F.S					5.6	738.3		
JAN 17 2006	SEE DAILY F.S					6.0	744.3		
JAN 18 2006	SEE DAILY F.S					6.1	750.4		
JAN 19 2006	SEE DAILY F.S.					2.5	752.9		
JAN 22 2006	SEE DAILY FS					5.5	758.4		
JAN 23 06	TIME CORRECTION FOR DEC 29/05					+ 0.1	758.5		
JAN 21 2006	SEE DAILY FS					1.2	759.7		
JAN 22 2006	SEE DAILY FS					1.6	761.3		
JAN 29 2006	SEE DAILY F.S					.9	762.2		
JAN 24/06	CCR6								

E & B Helicopters LTD. RS Number W.O # 3089 Log Entry - 1/24/06
C-FBXP Tach Time 762.2 Total Time 762.2

AMO 215-91

50 Hr Oil Change carried out Replaced oil filter p/n CH48108-1 and serviced engine with 5l of Phillips 20w50 oil A/C ground run and leak check carried out servicable

The maintenance described above has been performed IAW the applicable standards of airworthiness.

Jan 24/06 DATE — SIGNATURE — M715447 LICENCE #

JAN 24 2006	SEE DAILY F.S.					3.0	765.2		
JAN 25 2006	SEE DAILY F.S.					1.0	766.2		
JAN 26 2006	SEE DAILY F.S.					1.5	767.7		
JAN 27 2006	SEE DAILY F.S.					2.6	770.3		

E & B Helicopters LTD. RS Number W.O.# 3092 Log Entry - 2/2/06
C-FBXP Tach Time 770.3 Total Time 770.3

AMO 215-91

Bear paws P/N 64001-01 installed IAW Aero Design drawing 64002.
Weight and balance calculated for experimental test flight by pilot

The maintenance described above has been performed in accordance with the applicable standards of airworthiness.

02 Feb 2006 DATE — SIGNATURE — M432782 LICENCE NO.

15 → (Brought forward) (Reporté)

Next scheduled maintenance:
Prochaine maintenance planifiée: _____ Due: Échéance: _____ (hr / cycles / h / cycles /

*Delete where inapplicable — Supprimer si ce n'est pas applicable

**Total time since new — Temps total depuis

CONFORMITY INSPECTION RECORD

Applicant	Aeronautical Product				Title of Change
	AERO DESIGN LTD. R22 BEAR PAW				R22 BEAR PAW INSTALLATION
	Make	Model	Serial No.	Region	
	ROBINSON	R22	3730		

Drawing No.	Applicant's Inspector Signature	Date	T.C. Inspection Signature	Date	Findings
64002	Rchiebele	02 Feb 2006		02 FEB 2006	

APPLICANT'S ATTESTATION

I hereby confirm that the prototype installation for the subject

☒ MODIFICATION,

☐ REPAIR,

☐ TSO/AP-TC ARTICLE

is in conformity with the applicable installation drawing(s) listed above and that necessary ground tests have been carried out.
[Please check (✓) the applicable box.]

Additional Information:

Signature: Rchiebele

TC INSPECTION

☒ ACCEPTABLE

☐ UNACCEPTABLE

Remarks:

Signature:

Jeff Clarke

From: Oucharek, Gregory [OUCHARG@tc.gc.ca]
Sent: Monday, January 30, 2006 1:02 PM
To: jeff@aerodesign.ca
Cc: ted@aerodesign.ca
Subject: FW: R22 Bear Paw / Cargo Mirror
Importance: High

Jeff / Ted,

See comments from Serge below. Some minor adjustments to the Flight Test plan. I will explain to him that the Bear Paw CP revision is pending but paragraphs are as originally established for the R44. Note also that TC will retain Flight paragraphs.

Regards,

Greg

-----Original Message-----
From: Massicotte, Serge
Sent: Monday, January 30, 2006 9:45 AM
To: Oucharek, Gregory
Subject: RE: R22 Bear Paw / Cargo Mirror

Greg,

sorry for the delay in replying to your emails ... I was busy in Mirabel and also here with recurrent training for most of last week. I have reviewed the CP and test plan for the ***mirror installation*** (CP Rev 1 dated 23 Jan ' 06 and FTP 649.02 Rev 0 dated 16 Jan ' 06). I have a few minor comments as follow:

CP
27.67 Climb: OEI - definitely not required for the R22/R44;
27.177 Static Directional Stability - should be added; and
27.231 General - should be added.

FTP
Include a qualitative assessment of directional stability (27.177); and
Ensure static stability is evaluated/longitudinal cyclic position recorded at the same power setting for all speeds selected (record subject power setting).

As for the ***Bear Paw*** testing, I have not seen any CP specifically for the R22. The FTP is acceptable however the same comments as for the mirror FTP apply (directional stability and static stability testing).

As far as AD 95-26-04 is concerned, it do not believe subject modifications will have any impact on it. I agree with Mr Wilcox doing subject flight testing however I want TC to retain signature for the flight test para's (same as we did last time).

Let's talk if you need further clarifications.

Regards,

Serge Massicotte
Engineering Test Pilot
Aircraft Certification - Transport Canada
(613) 941-6212

-----Original Message-----
From: Oucharek, Gregory
Sent: Wednesday, January 25, 2006 1:39 PM
To: Massicotte, Serge
Subject: FW: R22 Bear Paw / Cargo Mirror
Importance: High

Serge,

Further to my voice message, please find attached a revised CP for the Cargo Mirror Installation. Ted has also requested delegation for all associated paragraphs. At this point I am seeking Flight Test acceptance of both test plans, FTP649 (Cargo Mirror) and FTP640 (Bear Paw) and a disposition on the extension of delegation request for the Flight related paragraphs (these were previously retained by FT on SH05-17). Also, I understand from a telephone conversation with Ted that the same pilot, Mr. Wilcox will be doing the flights. This was deemed acceptable on the original program.

If you have any questions or concerns, please give me a call.

Cheers,

Greg Oucharek, P. Eng
Transport Canada Civil Aviation
Senior Engineer, Aircraft Certification
Prairie & Northern Region,
Calgary, Alberta
(403) 292-4990

-----Original Message-----
From: E. Burgoin [mailto:ted@aerodesign.ca]
Sent: Wednesday, January 25, 2006 11:10 AM
To: Oucharek, Gregory
Subject: Re: R22 Bear Paw / Cargo Mirror

We will fly them as seperate tests since they will be seperate STC's. This is the requirement. As with any STC though it is up to the installer to determine that there is no incompatability with any other modification.

From my experience with this kind of thing we are concerned with vibration and this is what I am mainly checking for. We are doing the rest of the flight test because of the regulatory requirement to "go through the motions" but realistically I am not expecting to find any change from the basic configuration.

If things work out time wise I will also probably fly them together simply because the opportunity is there to

do it. Again, the point of interest will be the vibration characteristics, but if we are up doing this I will spend the extra half hour to go through the whole program.

Are we just about good to go on this? As soon as your cohorts are out of here I need to be doing this. E & B has a new R22 to deliver with the bear paws on it, probably in about a week and a half.

Thanks Greg.

Ted.

----- Original Message -----
From: Oucharek, Gregory
To: E. Burgoin (E-mail)
Cc: Jeff Clarke (E-mail)
Sent: Wednesday, January 25, 2006 10:40 AM
Subject: R22 Bear Paw / Cargo Mirror

Ted,

One further point of clarification, are you planning to fly the mirror concurrently with the bear paws or are these two distinct tests as published (FTP649 vs FTP640).

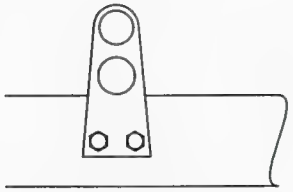
Thanks for cleaning up the CP. I will continue working with Serge for acceptance but would like a response to my question.

Regards,

Greg Oucharek, P. Eng
Transport Canada Civil Aviation
Senior Engineer, Aircraft Certification
Prairie & Northern Region,
Calgary, Alberta
(403) 292-4990

ATTN: ED E+B HELICOPTERS

FROM: AERO DESIGN LTD.



A/R			WASHER	STAINLESS STEEL	COMMERCIAL	1.0 OD X 0.063 THICK
2	MS21044N3		NUT			
A/R	AN970-10		WASHER			
A/R	AN3-10A		BOLT			
A/R	AN3-7A		BOLT			
4	MS21044N4		NUT			
A/R	AN960-416		WASHER			
A/R	AN970-4		WASHER			
4	AN4-30A		BOLT			
4	64021-03	05	AFT SPACER			
4	64021-02	04	FWD SPACER			
1	64010-02	03	RIGHT PAW ASSEMBLY			
1	64010-01	02	LEFT PAW ASSEMBLY			
	64001-01	01	INSTALLATION			
01	PART NO.	ITEM	DESCRIPTION	MATERIAL	MATERIAL SPEC	STOCK SIZE
QTY	LIST OF MATERIALS					

WEIGHT AND BALANCE

ITEM	DESCRIPTION	WEIGHT (LB)	LONGITUDINAL ARM (IN)	LONGITUDINAL MOMENT (LB-IN)	LATERAL ARM (IN)	LATERAL MOMENT (LB-IN)
01	BEAR PAWS INSTALLATION	5	123.6	618	0	0

BASIC CODE REF. NAS 523

DASH NO. FOR DIAMETER
N=MFD. HEAD NEAR SIDE
F=MFD. HEAD FAR SIDE

C=COUNTERSUNK
D=DIMPLE
DIGIT=# OF SHEETS TO BE DIMPLED

DASH NO. FOR LENGTH

BASIC CODES:
BJ=MS20470AD
BB=MS20426AD
ARN=CR3213
ARM=CR3212

INSTALL NEW RIVET
REMOVE/REPLACE RIVET
EXISTING RIVET

APPROVALS		DATE
DRAWN:	JEFF CLARKE	10 JUNE 2005
CHECKED:	E. BURGOIN	

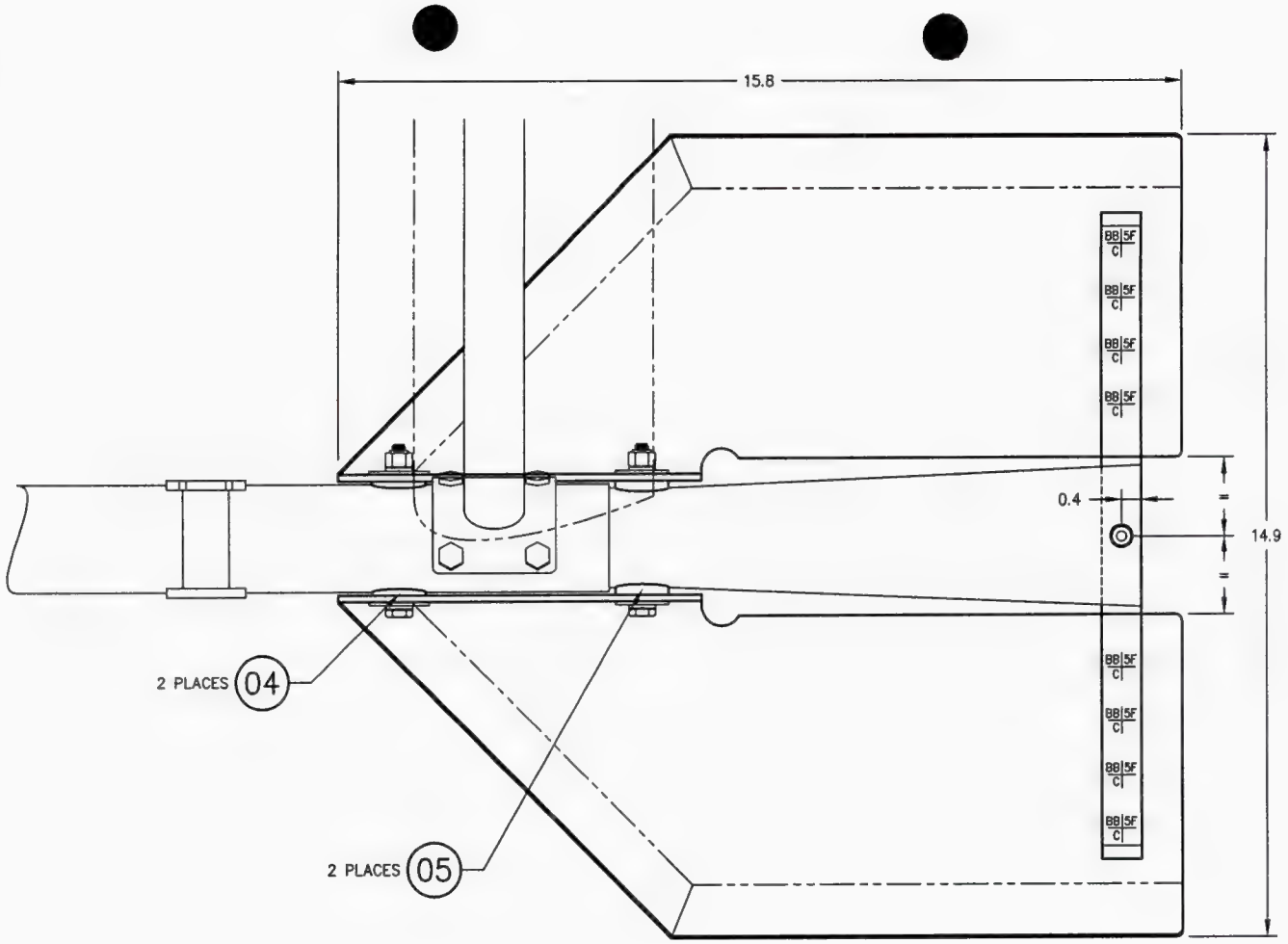
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES.
TOLERANCES ON:

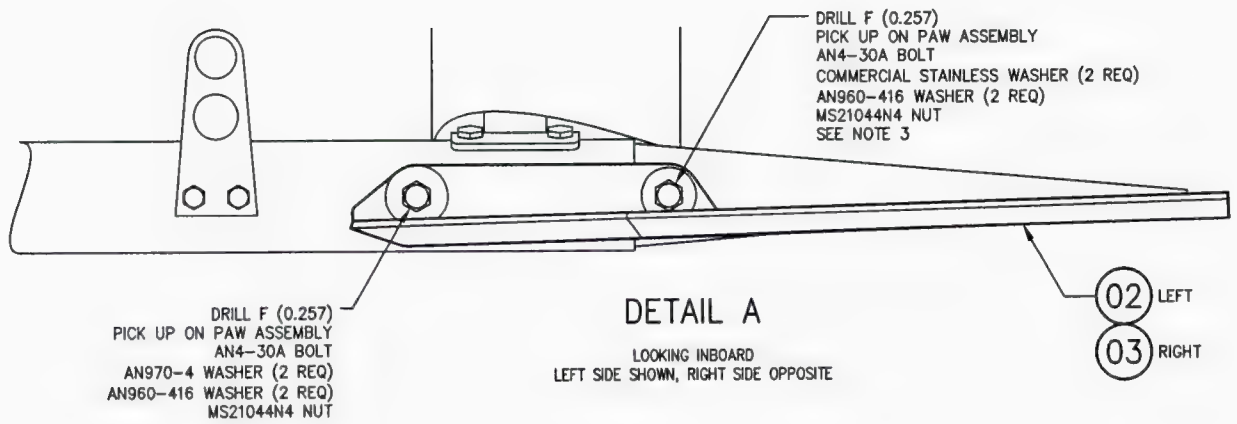
DECIMALS		ANGLES
X.XXX	±0.010	±1/2°
X.XX	±0.03	
X.X	±0.1	

AERO DESIGN LTD.
CONSULTING ENGINEERS, TRANSPORT CANADA APPROVALS, DAR 290M
2013 - 39TH AVENUE N.E., CALGARY, ALBERTA, CANADA, T2E 6R7
tel: (403) 250-6027 fax: (403) 250-8333 aerodesign@telusplanet.net

ROBINSON R22
BEAR PAWS INSTALLATION
INSTALLATION

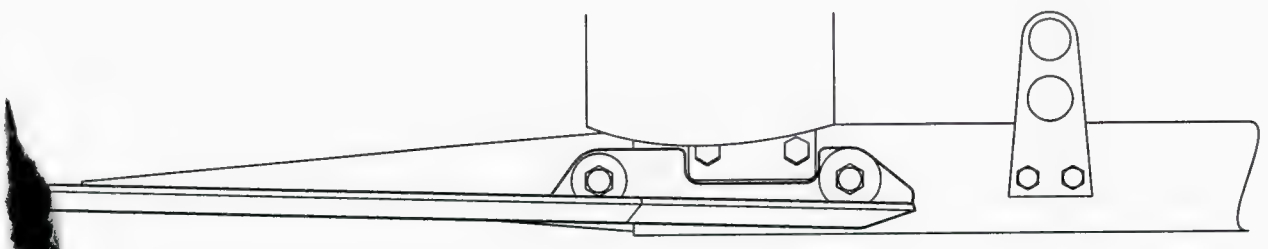
SCALE 1 : 2	DWG. SIZE	DWG. NO.	REV.
SHEET 1 OF 1	A1	64002	0

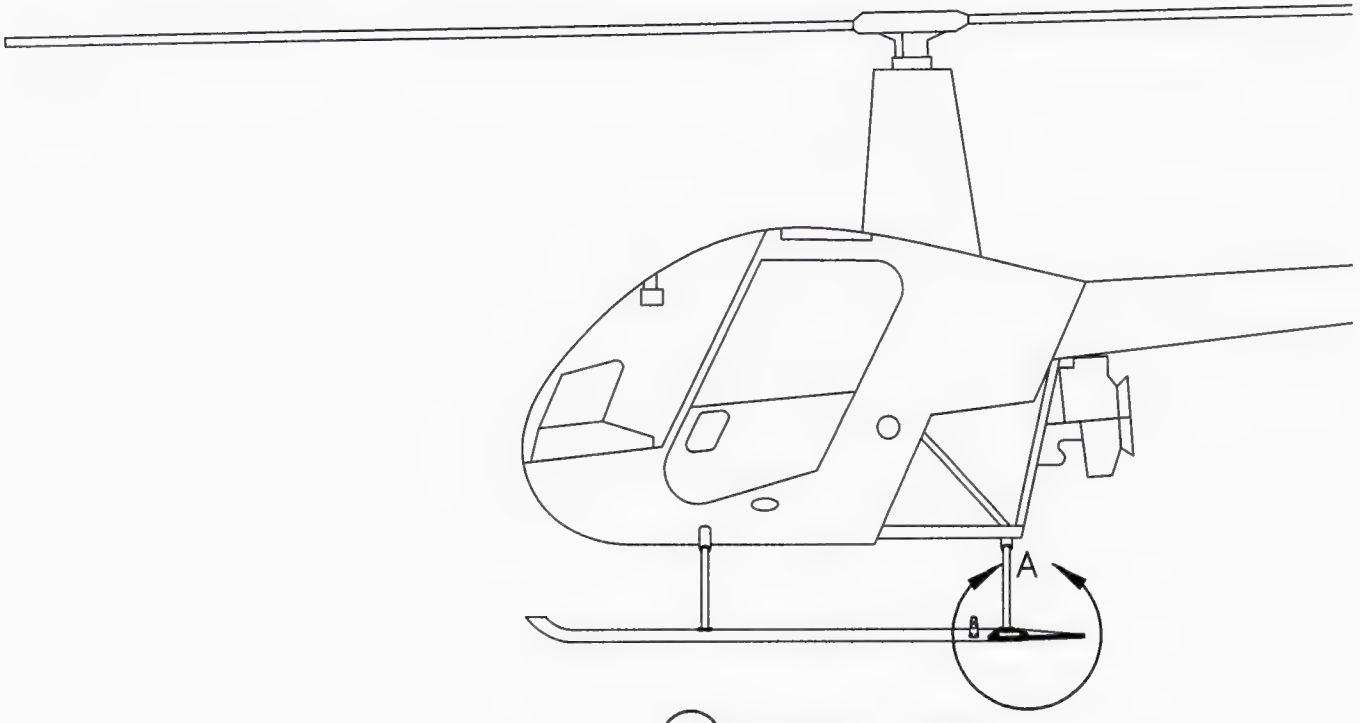




DETAIL A

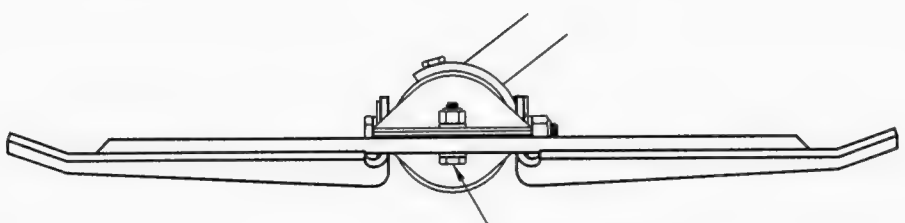
LOOKING INBOARD
LEFT SIDE SHOWN, RIGHT SIDE OPPOSITE





01 INSTALLATION

SCALE 1 : 1

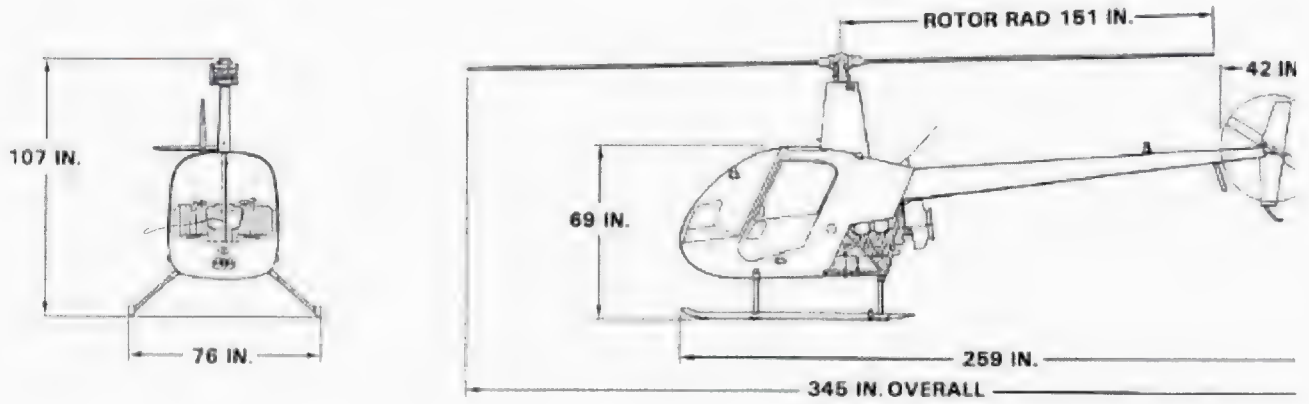


DRILL #9 (0.196)
PICK UP ON PAW ASSEMBLY
AN3-7A OR -10A BOLT
AN960-10 WASHER (2 REQ)
MS21044N3 NUT

E

R22 Beta II

Specifications and Dimensions



Weights	
Gross Weight	1,370 lb
Empty Weight Equipped (w/full oil)	855 lb
Fuel (19.2 gal)	115 lb
Optional Auxiliary Fuel (10.5 gal)	63 lb
Passengers and Baggage w/stnd fuel	63 lb

Powerplant

Lycoming O-360 Four-Cylinder, Air-Cooled

Derated to 131 horsepower at 2652 rpm

Performance	
Maximum Airspeed (Vne)	118 mph (102 kts)
Cruise Airspeed @ 70% Power	110 mph (96 kts)
Maximum Range (no reserve)	Over 200 miles
Maximum Range (w/aux fuel)	Over 300 miles
Average Fuel Consumption	8 to 10 gph
Rate-of-Climb at Sea Level	Over 1,000 fpm
Rate-of-Climb at 10,000 Feet	Over 600 fpm
Maximum Operating Altitude	14,000 feet
Hover Ceiling IGE @ 1370 GW	9,400 feet

AERO Design Ltd.

FLIGHT TEST PLAN

FTP 640.03

Installation of Bear Paws

Robinson R-22

Revision 0
16 January, 2006

AERO Design Ltd.
Engineering Consultants

2013 – 39th Avenue N.E., Calgary, Alberta T2E 6R7
Phone: (403) 250-8027
Fax: (403) 250-8333
E-Mail: aerodesign@telusplanet.net

TABLE OF CONTENTS

1.0 INTRODUCTION

Bear Paws are installed on the Robinson R22 series to improve stability when landing on soft terrain, such as snow.

2.0 REFERENCE

Rotorcraft Flight Manual, Robinson R22

Aero Design Ltd. Installation Drawing 64002, Bear Paws.

3.0 BASIS OF CERTIFICATION

R22, R22 Alpha, R22 Beta, R22 Mariner

Type Certificate H10WE

FAR 27, including Amendment 27-10.

This flight test programme will demonstrate that the installation of Bear Paws complies with the flight requirements of the original basis of certification.

4.0 FLIGHT TEST PREPARATION

4.1 General

The flight crew should review and be familiar with the regulatory requirements of FAR 27 Subpart B - Flight prior to conducting flight tests. These requirements are included as Appendix A.

The flight crew should examine and be familiar with the modification installed including a review of the proposed Flight Manual Supplement.

The relative cyclic stick position in the various flight conditions is to be determined by attaching light retracting type tape measures between the cyclic stick and the airframe in both the longitudinal and lateral directions.

Test points must be flown accurately allowing the aircraft to stabilize before data is recorded.

Each limiting condition should be approached with caution, using an incremental build-up approach.

The flight crew should always be attentive to unusual noises, vibrations, control characteristics, attitudes and instrument indications.

4.2 Configuration

Baseline flight

The helicopter shall be in the same configuration as flown for the modification flight test except that the external portions of the modification shall be removed. The helicopter shall be ballasted to obtain the same gross weight and centre of gravity as flown for the modification flight test.

Modification flight test

Those components of the modification which alter the external profile of the aircraft shall be installed in accordance with the applicable installation drawings.

Any other unusual or particularly large external modifications should be removed if practical and all external modifications installed during flight testing should be noted in the flight test report.

The aircraft is to be ballasted to its maximum gross weight.

4.3 Flight Authority

The Certificate of Airworthiness may not be valid after the modification has been installed. Flight Authority in the form of a flight permit may be required.

Flight authority to exceed the published V_{ne} of the helicopter is required. When the V_{ne} for the modification as provided in the proposed Flight Manual Supplement does not restrict the maximum speed to less that 90% of the basic helicopter V_{ne} then, the flight permit should specifically state that a higher V_{ne} is authorized.

4.4 Definitions

Stability: It shall be possible to fly the helicopter in normal maneuvers for a continuous period of time appropriate to the operational use of the particular type of helicopter without the pilot experiencing undue fatigue or strain.

Static longitudinal stability: The characteristics of the longitudinal cyclic control shall be such that, with constant throttle and collective pitch settings, a rearward displacement of the longitudinal control shall be necessary to obtain and maintain speeds below the specified trim speed, and a forward displacement shall be necessary to obtain and maintain speeds above the specified trim speed.

Adequate control margins: There is adequate control and stick movement available from the position at the trim speed to the control stops or other obstructions to stick movement to safely control the helicopter.

5.0 FLIGHT TEST PROCEDURE

5.1 Flight Characteristics

Controllability Stability Flutter and Vibration

FAR 27.141, 27.143, 27.171 and 27.629

Low Speed

FAR 27.141(b), 27.143(a), 27.143(c), 27.171, 27.175(d) and 27.629

Hover in a fixed position at a skid height of approximately 5 – 15 ft above the ground

Translate in both sideward directions and in a rearward direction into the prevailing wind until airspeed estimated to be 17 knots (20 mph) has been reached.

Record:
- adequate control margins
- Relative lateral and longitudinal stick position (tape measurement)
- Observe and record any indications of flutter or vibrations

Climb

FAR 27.141(b), 27.143(a), 27.171, 27.175(a) and 27.629

At the recommended climb speed, V_y, from the Basic Flight Manual increase power slowly until reaching Maximum Continuous Power

Make a 30° bank turn to the left and to the right

Record:
- adequate control margins
- Relative lateral and longitudinal stick position
- Positive static longitudinal stability
- Observe and record any indications of flutter or vibrations

Level Flight

FAR 27.141(b), 27.143(a), 27.171, 27.175(b), 27.177, and 27.629

Transition from hover to forward flight increasing the speed incrementally in 10 mph steps until Maximum Continuous Power is being applied, or V_{ne} from the proposed Flight Manual Supplement is reached, whichever is less.

At each speed increment make a 30° bank turn to the left and the right

Record:
- adequate control margins
- Relative lateral and longitudinal stick position
- Positive static longitudinal stability
- Observe and record any indications of flutter or vibrations

In the basic Flight Manual, V_{ne} is 98 KCAS.

At Maximum Continuous Power, V_h, or V_{ne} from the proposed Flight Manual Supplement, whichever is less

FAR 27.143(a)

Record:
- stable airspeed, V_h
- record if V_{ne} was reached prior to applying MCP

Continue to accelerate the aircraft in 10 mph increments by maintaining Maximum Continuous Power and descending as necessary V_{ne} is reached.

FAR 27.143(b) and 27.629

At each speed increment make a 30° bank turn to the left and to the right

At V_{ne} ensure there are adequate control margins and adequate pitch control

Record:
- adequate control margins
- Relative lateral and longitudinal stick position
- Positive static longitudinal stability
- Observe and record any indications of flutter or vibrations

For the flight test with modification installed only

Compare the longitudinal stick position (as measured with the measuring tape attached to the cyclic stick) for modification installed flight test to the position obtained in the baseline flight at V_{ne} this point. If the longitudinal stick position is further forward at V_{ne} with the modification installed (basic helicopter V_{ne} or proposed Flight Manual Supplement V_{ne}, whichever is less) than was determined during the baseline flight at V_{ne} then it may be necessary to further limit the V_{ne} with the modification installed due to mast bending considerations.

Applying power as required, and further descending the helicopter if necessary, cautiously accelerate the helicopter until the longitudinal cyclic stick position is in the same location as was determined in the baseline flight at V_{ne} from the basic helicopter Flight Manual.

Record:
- speed at which, for the modification installed, longitudinal cyclic stick position is in the same location as was determined in the baseline flight at the V_{ne}.

Autorotation

FAR 27.141(b), 27.143(a)(v), 27.143(d), 27.175(c) and 27.629

At each of V_y, normal cruise speed and V_h, from level flight (if possible) simulate a sudden engine failure by rapidly retarding the throttle to the idle position. The collective stick must be kept in the power-on position for at least one (1) second after the throttle is retarded before any response is made.

Record:
- assess that autorotation entry characteristics not changed from basic aircraft
- observe and report any unusually rapid rotor speed decay.
- For entry speed at V_h, adequate pitch and roll control

During descent, vary forward speed between 50% $V_{min\ rate\ of\ descent}$ and $V_{ne\ autorotation}$, making gentle turns to the left and to the right.

Record:
- adequate control margins
- unusual pitch, roll or yaw rates
- observe and record any indications of flutter or vibrations

5.2 Performance

FAR 27.65(b)

If the external modification is of significant size and shape as to affect the climb performance of the helicopter the following procedure shall be included in the flight test.

On a compass heading at 90° to the local wind conditions, from level flight at the recommended climb speed, V_y, increase power to Maximum Continuous Power maintaining airspeed. When a steady rate of climb is established, note the altimeter reading and measure the time to climb through an altitude of 1000 ft.

Record:
- Starting altitude
- Time to climb through 1000 ft.

Repeat the above procedure on the reciprocal compass heading starting at the same altitude

Record:
- Starting altitude
- Time to climb through 1000 ft.

5.3 Flight at Demonstration Speed

FAR 27.629, 27.309 and 27.1505(a)

Caution: The rotorcraft should be maneuvered gently above V_{ne}

The aircraft should be accelerated slowly above V_{ne} to ensure the target airspeed is not passed.

Applying Maximum Continuous Power and descending the aircraft as required, cautiously accelerate the aircraft to 1.11 times V_{ne}

Make a 30° bank turn to the left and the right

Record:
- maximum airspeed attained
- observe and record any indications of flutter or vibrations

In the basic Flight Manual, V_{ne} is 98 KCAS, therefore V_d must not exceed 109 KCAS.

5.4 Take off and Landing

FAR 27.51(a)(1), 27.75(a)(1) and 27.231

With the modification installed, perform a landing on soft ground. Observe for tendency of the installation to stick or catch in the soft ground, or any other condition that may create a hazard.

Take off from soft ground. Observe for tendency of the installation to stick or catch in the soft ground, or any other condition that may create a hazard.

5.5 Other Observations

Effect of modification on normal and emergency procedures

Record: - Comment

Effect of modification on normal and emergency egress

Record: - Comment

Evaluation of modification Flight Manual Supplement

Record: - Comment

APPENDIX A

FLIGHT TEST REPORT

APPENDIX B

WEIGHT AND BALANCE CALCULATIONS

APPENDIX C

FAR 27 REQUIREMENTS

Sec. 27.65 – Climb: All engines operating.

(a) For rotorcraft other than helicopters--
(1) The steady rate of climb, at V_Y, must be determined--
(i) With maximum continuous power on each engine;
(ii) With the landing gear retracted; and
(iii) For the weights, altitudes, and temperatures for which certification is requested; and
(2) **[**The climb gradient, at the rate of climb determined in accordance with paragraph (a)(1) of this section, must be either--**]**
(i) At least 1:10 if the horizontal distance required to take off and climb over a 50-foot obstacle is determined for each weight, altitude, and temperature within the range for which certification is requested; or
(ii) **[**At least 1:6 under standard sea level conditions.**]**
(b) Each helicopter must meet the following requirements:
(1) V_Y must be determined--
(i) For standard sea level conditions;
(ii) At maximum weight; and
(iii) With maximum continuous power on each engine.
(2) **[**The steady rate of climb must be determined--
(i) At the climb speed selected by the applicant at or below V_{NE};
(ii) Within the range from sea level up to the maximum altitude for which certification is requested;
(iii) For the weights and temperatures that correspond to the altitude range set forth in paragraph (b)(2)(ii) of this section and for which certification is requested; and
(iv) With maximum continuous power on each engine.**]**

Sec. 27.141 – Flight Characteristics: General.

The rotorcraft must--
[(a) Except as specifically required in the applicable section meet the flight characteristics requirements of this subpart--
(1) At the altitudes and temperatures expected in operation;**]**
(2) Under any critical loading condition within the range of weights and centers of gravity for which certification is requested;
(3) For power-on operations, under any condition of speed, power, and rotor r.p.m. for which certification is requested; and
(4) For power-off operations, under any condition of speed and rotor r.p.m. for which certification is requested that is attainable with the controls rigged in accordance with the approved rigging instructions and tolerances;
(b) Be able to maintain any required flight condition and make a smooth transition from any flight condition to any other flight condition without exceptional piloting skill, alertness, or strength, and without danger of exceeding the limit load factor under any operating condition probable for the type, including--
(1) Sudden failure of one engine, for multiengine rotorcraft meeting Transport Category A engine isolation requirements of Part 29 of this chapter; and
(2) Sudden, complete power failure, for other rotorcraft; and
(3) Sudden, complete control system failures specified in Sec. 27.695 of this Part; and
(c) Have any additional characteristic required for night or instrument operation, if certification for those kinds of operation is requested. Requirements for helicopter instrument flight are contained in Appendix B of this Part.

Sec. 27.143 – Controllability and maneuverability.

(a) The rotorcraft must be safely controllable and maneuverable--
(1) During steady flight; and
(2) During any maneuver appropriate to the type, including--
(i) Takeoff;
(ii) Climb;
(iii) Level flight;
(iv) Turning flight;
(v) Glide;
(vi) Landing (power on and power off); and
(vii) Recovery to power-on flight from a balked autorotative approach.
(b) The margin of cyclic control must allow satisfactory roll and pitch control at V_{NE} with--
(1) Critical weight;
(2) Critical center of gravity;
(3) Critical rotor r.p.m.; and
(4) Power off (except for helicopters demonstrating compliance with paragraph (e) of this section) and power on.
(c) A wind velocity of not less than 17 knots must be established in which the rotorcraft can be operated without loss of control on or near the ground in any maneuver appropriate to the type (such as crosswind takeoffs, sideward flight, and rearward flight), with--
(1) Critical weight;
[(2) Critical center of gravity;
(3) Critical rotor r.p.m.; and
(4) Altitude, from standard sea level conditions to the maximum altitude capability of the rotorcraft or 7,000 feet, whichever is less.**]**
(d) The rotorcraft, after (1) failure of one engine in the case of multiengine rotorcraft that meet Transport Category A engine isolation requirements, or (2) complete engine failure in the case of other rotorcraft, must be controllable over the range of speeds and altitudes for which certification is requested when such power failure occurs with maximum continuous power and critical weight. No corrective action time delay for any condition following power failure may be less than--
(i) For the cruise condition, one second, or normal pilot reaction time (whichever is greater); and
(ii) For any other condition, normal pilot reaction time.
(e) For helicopters for which a V_{NE} (power-off) is established under Sec. 27.1505(c), compliance must be demonstrated with the following requirements with critical weight, critical center of gravity, and critical rotor r.p.m.:
(1) The helicopter must be safely slowed to V_{NE} (power-off), without exceptional pilot skill, after the last operating engine is made inoperative at power-on V_{NE}.
(2) At a speed of 1.1 V_{NE} (power-off), the margin of cyclic control must allow satisfactory roll and pitch control with power off.

Sec. 27.171 – Stability: General

The rotorcraft must be able to be flown, without undue pilot fatigue or strain, in any normal maneuver for a period of time as long as that expected in normal operation. At least three landings and takeoffs must be made during this demonstration.

Sec. 27.173 – Static longitudinal stability.

[(a) The longitudinal control must be designed so that a rearward movement of the control is necessary to obtain a speed less than the trim speed, and a forward movement of the control is necessary to obtain a speed more than the trim speed.
(b) With the throttle and collective pitch held constant during the maneuvers specified in Sec. 27.175(a) through (c), the slope of the control position versus speed curve must be positive throughout the full range of altitude for which certification is requested.
(c) During the maneuver specified in Sec. 27.175(d), the longitudinal control position versus speed curve may have a negative slope within the specified speed range if the negative motion is not greater than 10 percent of total control travel.]

Sec. 27.175 – Demonstration of static longitudinal stability.

(a) *Climb.* Static longitudinal stability must be shown in the climb condition at speeds from 0.85 V_Y to 1.2 V_Y, with--
(1) Critical weight;
(2) Critical center of gravity;
(3) Maximum continuous power;
(4) The landing gear retracted; and
(5) The rotorcraft trimmed at V_Y.
(b) *Cruise.* Static longitudinal stability must be shown in the cruise condition at speeds from 0.7 V_H or 0.7 V_{NE}, whichever is less, to 1.1 V_H or 1.1 V_{NE}, whichever is less, with--
(1) Critical weight;
(2) Critical center of gravity;
(3) Power for level flight at 0.9 V_H or 0.9 V_{NE}, whichever is less;
(4) The landing gear retracted; and
(5) [The rotorcraft trimmed at 0.9 V_H or 0.9 V_{NE}, whichever is less.]
(c) *Autorotation.* Static longitudinal stability must be shown in autorotation at airspeeds from 0.5 times the speed for minimum rate of descent to V_{NE} or to 1.1 V_{NE} (power-off) if V_{NE} (power-off) is established under Sec. 27.1505(c), and with--
(1) Critical weight;
(2) Critical center of gravity;
(3) Power off;
(4) The landing gear--
(i) Retracted; and
(ii) Extended; and
(5) The rotorcraft trimmed at appropriate speeds found necessary by the Administrator to demonstrate stability throughout the prescribed speed range.
(d) *Hovering.* For helicopters, the longitudinal cyclic control must operate with the sense and direction of motion prescribed in Sec. 27.173 between the maximum approved rearward speed and a forward speed of 17 knots with--
(1) Critical weight;
(2) Critical center of gravity;
(3) Power required to maintain an approximate constant height in ground effect;
(4) The landing gear extended; and
(5) The helicopter trimmed for hovering.

Sec. 27.177 – Static directional stability.

[Static directional stability must be positive with throttle and collective controls held constant at the trim conditions specified in Sec. 27.175 (a) and (b). This must be shown by steadily increasing directional control deflection for sideslip angles up to $\pm 10°$ from trim. Sufficient cues must accompany sideslip to alert the pilot when approaching sideslip limits.]

INSTRUCTIONS FOR CONTINUED AIRWORTHINESS
ICA 640.91

BEAR PAWS INSTALLATION

Robinson R22, R22 Alpha/Beta/Mariner

Preface

These Instructions for Continued Airworthiness shall be included in the Robinson R22, R22 Alpha, R22 Beta, or R22 Mariner Maintenance Manual when the Bear Paws are installed in accordance with AERO Design Ltd. Document Control List DCL640-1, Revision 0, or later approved revision.

The information contained herein supplements the information in the basic Maintenance Manual. For Maintenance practices and procedures not contained in these Instructions for Continued Airworthiness refer to the basic Maintenance Manual and its approved supplements.

Revision 0
Date: 24 January, 2006

AERO Design Ltd.
2013 39th Avenue N.E., Calgary, Alberta T2E 6R7
Phone: (403) 250-8027
Fax: (403) 250-8333

RECORD OF REVISIONS

Revision Number	Issue Date	Date Inserted	By
0			Original Issue

LIST OF EFFECTIVE PAGES

Chapter – Section - Subject	Page	Revision No.
5-TITLE	1	0
5-EFFECTIVITY	2	0
5-00-00	3	0
5-10-00	4-8	0

TABLE OF CONTENTS

SECTION 5 – LANDING GEAR

5-1 INTRODUCTION

The following Instructions for Continued Airworthiness (ICA) satisfy the requirements of 14 CFR 27.1529, and provide the information necessary to complete the on-going maintenance and inspections required for the Robinson R22 series rotorcraft when modified with the Bear Paws Installation as described herein. The installation is the same for all models of R22 rotorcraft.

5-2 REFERENCE DOCUMENTS

AERO Design Ltd. Installation drawing 64002

5-3 DEFINITIONS AND ABBREVIATIONS

BL - Butt Line (RBL is Right Butt Line, LBL is Left Butt Line)
FS - Flight Station
ICA - Instructions for Continued Airworthiness
P/N - Part Number

5-4 GENERAL DESCRIPTION

The Bear Paws Installation consists of a pair of pads made of Aluminum sheet, attached at the aft end with an aluminum strap. The paws are bolted to the aft end of the skid tube. Spacers are installed to match the radius of the skid tube.

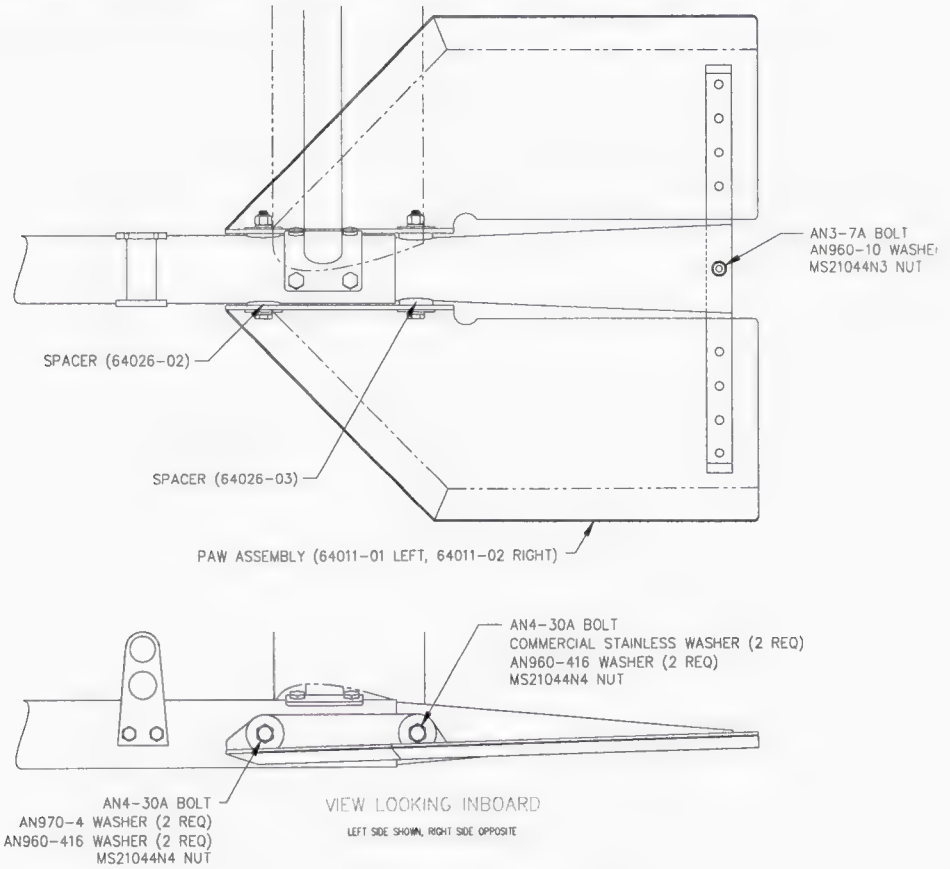


Figure 1 – Bear Paw Installation

5-5 CONTROL AND OPERATING INFORMATION

Not applicable.

5-6 SERVICING INFORMATION

The Bear Paws Installation does not affect the original rotorcraft servicing information. All components used with the Bear Paws Installation are "On Condition" items. Periodic servicing is not required.

5-7 MAINTENANCE INSTRUCTIONS

1. Inspection Schedule and Instructions

Continued airworthiness is contingent upon compliance with the following inspection items. These items shall be completed in conjunction with the Robinson R22 Maintenance Inspection schedule, or other approved program, or upon removal and replacement of any component of the Bear Paws Installation.

Daily Inspection

1. Inspection Area: Skid Tube
    a) Inspect the bear paws for any signs of deformation, cracks or corrosion.
    b) Inspect the AN4 and AN3 bolts attaching the bear paws for condition and security.

100 hour or Annual Inspection

1. Inspection Area: Skid Tube
    a) Remove bear paws.
    b) Inspect bear paws for any signs of scratches, gouges, deformation, cracks, corrosion or other damage.
    c) Inspect fastener holes in skid tubes for elongation, wear, or other damage.
    d) Re-install bear paws.

2. Repair Instructions

a) Refer to figure 2. Scratches or gouges in section A (top or bottom) not exceeding 0.050" deep may be blended/faired out to a smooth transition.

b) Refer to figure 2. Scratches or gouges in section B (top or bottom) not exceeding 0.063" deep may be blended/faired out to a smooth transition.

c) Bear paws with scratches or gouges exceeding the above limits will be removed from service.

d) Refer to section 5-13 for protective treatment and paint information. Protective treatment is not required on bottom surface of paws.

e) Do not repair cracks in the bear paw. If cracks are found, paw is to be removed from service and a new paw installed.

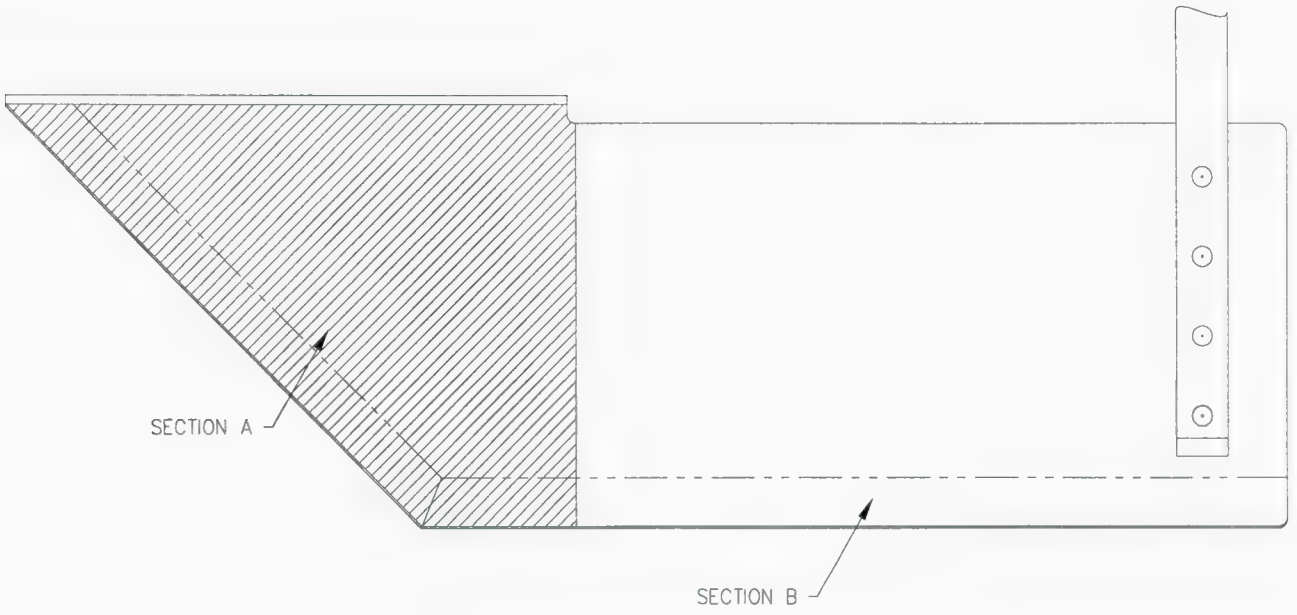


Figure 2 – Bear Paw Repair Sections

5-8 TROUBLE SHOOTING INFORMATION

Not applicable.

5-9 REMOVAL AND REPLACEMENT INFORMATION

1. Bear Paws Removal

Refer to figure 1.

1. Remove two (2) MS21044N4 nuts, four (4) AN960-416 washers, two (2) AN970-4 washers (front) or two (2) commercial stainless steel washers (rear), and two (2) AN4-30A bolts securing forward end of bear paw to skid tube.
2. Remove two (2) 64026-02 forward spacers and two (2) 64026-03 aft spacers.
3. Remove one (1) MS21044N3 nut, two (2) AN960-10 washers and one (1) AN3-7A bolt securing aft end of bear paw to skid tube.
4. Remove bear paw.
5. Repeat for opposite side.

2. Bear Paws Installation

Refer to figure 1.

1. Position bear paw on aft end of skid tube. Locate forward end on existing holes.
2. Position one (1) 64026-02 spacer on either side of skid tube on forward mounting hole.

3. Install one (1) AN4-30A bolt, two (2) AN960-416 washers, two (2) AN970-4 washers, and one (1) MS21044N4 nut in forward mounting hole.
4. Position one (1) 64026-03 spacer on either side of skid tube on aft mounting hole.
5. Install one (1) AN4-30A bolt, two (2) AN960-416 washers, two (2) commercial stainless steel washers, and one (1) MS21044N4 nut in aft mounting hole.
6. Torque AN4 bolts to 50-70 in-lbs.
7. Insert one (1) AN3-7A bolt with one (1) AN960-10 washer through hole in strap into hole in aft end of skid tube.
8. Install one (1) AN960-10 washer and one (1) MS21044N4 nut onto AN3-7A bolt.
9. Torque AN3 bolt to 20-25 in-lbs.
10. Repeat for opposite side.

5-10 MARKINGS AND PLACARDS

Not applicable.

5-11 DIAGRAMS OF ACCESS PANELS

Not applicable.

5-12 SPECIAL INSPECTION TECHNIQUES AND INSTRUCTIONS

1. Hard Landing

Following a hard landing inspect the Bear Paws Installation in accordance with the 100 hour or annual inspection listed above in Section 5-7.

5-13 PROTECTIVE TREATMENT INFORMATION

The Bear Paws are to be alodined, primed with epoxy primer, and painted matte black with polyurethane paint.

Bear Paws are to be painted matte black to prevent objectionable reflections off the bear paws into the cockpit.

5-14 STRUCTURAL FASTENER DATA

Refer to basic helicopter maintenance manual.

5-15 LIST OF SPECIAL TOOLS

Not applicable.

5-16 AIRWORTHINESS LIMITATIONS

The Airworthiness Limitations section is Transport Canada approved and specifies maintenance required under Section 571 of the Canadian Aviation Regulations, unless an alternative program has been approved.

No additional limitations have been imposed due installation of the Bear Paws Installation.

5-17 DISTRIBUTION AND AMENDMENTS

Copies of this ICA and amendments shall be distributed to all known purchasers of the Bear Paws Installation.

AERO **DESIGN LTD.**
2013 – 39th Ave N. E., Calgary, Alberta, T2E 6R7 aerodesign@telusplanet.net

F A X C O V E R S H E E T

DATE:	January 26, 2006	**TIME:**	10:45 ~~10:16~~ AM
TO:	**Ed Wilcock**	**PHONE:**	250-287-4421
	E&B Helicopters	**FAX:**	250-287-4352
FROM:	J. Clarke Aero Design Ltd.	**PHONE:** **FAX:**	403-250-8027 403-250-8333

Number of pages including cover sheet: 3

RE: FLIGHT PERMIT APPLICATION

Ed,

Attached are the flight permit applications for flight testing of the bear paws and mirror. Complete the forms and submit it to your Transport Canada contact person. They may want to contact Greg Oucharek at Transport Canada Aircraft Certification here in Calgary at 403-292-4990.

If multiple registrations are required for the R22 (if the mirror is on one machine and bear paws on another), please confirm with your Transport Canada contact that the same flight permit may be used, or apply for an additional flight permit.

Jeff Clarke.

Jeff

Transport Canada / Transports Canada
Aviation / Aviation

APPLICATION FOR A FLIGHT PERMIT
DEMANDE DE PERMIS DE VOL

INSTRUCTIONS ▶ Print or type all entries. See Airworthiness Manual Chapter 507D and Airworthiness Manual Advisory AMA 507D/1 for the use and disposition of this form.
Dactylographier ou écrire en lettres moulées. Consulter le chapitre 507D du Manuel de navigabilité et la circulaire consultative AMA 507 D/1 qui précisent la façon de remplir et d'acheminer la présente formule.

A. AIRCRAFT IDENTIFICATION — IDENTIFICATION DE L'AÉRONEF

1. Owner - Propriétaire

2. Address - Adresse

3. Aircraft Manufacturer - Constructeur de l'aéronef	4. Model - Modèle	5. Serial Number - Numéro de série	6. Nationality and Registration Marks Marques de nationalité et d'immatriculation
Robinson	R22		

B. FLIGHT PERMIT REQUESTED - *Check applicable boxes* — PERMIS DE VOL DEMANDÉ - *Cocher la ou les case(s) voulue(s)*

1. ☐ Experimental Flight Permit / Permis de vol expérimental

2. ☐ Specific Purpose Flight Permit / Permis de vol à une fin spécifique

(a) ☐ Ferry Flight / Vol de convoyage
(b) ☐ Importation or Exportation Flight / Vol à l'importation ou à l'exportation
(c) ☐ Demonstation, Market Survey or Crew Training / Vol de démonstration, étude de marché ou formation d'équipage
(d) ☒ Flight Test following repair, modification or maintenance / Essais en vol après réparation, modification ou maintenance
(e) ☐ Other purpose (Specify) / Autre fin (Préciser)

C. FLIGHT DESCRIPTION AND AIRCRAFT LIMITATIONS — DESCRIPTION DU VOL ET LIMITATIONS DE L'AÉRONEF
Description of Flight(s) *Use attachment when appropriate* — Description du ou des vol(s) Joindre une feuille au besoin

1. From - Aérodrome de départ	2. To - Aérodrome de destination	
Campbell River (YBL)	Campbell River (YBL)	
3. Via - Escales	4. Date	5. Duration - Durée
	27 January 2006	90 days

6. Aircraft does not meet the applicable airworthiness requirements as follows: - Raisons pour lesquelles l'aéronef ne satisfait pas aux exigences de navigabilité en vigueur:

Bear Paws installed in accordance with AERO Design Ltd. drawing 64002.

And/Or

Mirror installed in accordance with AERO Design Ltd. drawing 64902.

7. The following restrictions are considered necessary for safe operations: - Les restrictions suivantes sont nécessaires pour la conduite des vols en toute sécurité:

- Occupants limited to persons involved with flight test program
- No flight over built up areas
- Day VFR conditions
- Vne = 108 KCAS (1.1 x Vne in RFM)
- Log book entry stating that the installation was performed in accordance with the drawings listed in section 6., signed by an AME

D. CERTIFICATION

I hereby certify that the aircraft described above is in a condition for safe operation. — Je, soussigné, certifie que l'aéronef décrit ci-dessus est en bon état de vol.

Signature	Date (Y-A - M - D-J)	
		☐ Registered Owner as shown on the Certificate of Registration / Propriétaire enregistré selon le certificat d'immatriculation ☐ Authorized Representative / Représentant autorisé

24-0044 (93.04)

Canada

Transport Canada / Transports Canada
Aviation / Aviation

APPLICATION FOR A FLIGHT PERMIT
DEMANDE DE PERMIS DE VOL

INSTRUCTIONS ▶ Print or type all entries. See Airworthiness Manual Chapter 507D and Airworthiness Manual Advisory AMA 507D/1 for the use and disposition of this form.
Dactylographier ou écrire en lettres moulées. Consulter le chapitre 507D du Manuel de navigabilité et la circulaire consultative AMA 507 D/1 qui précisent la façon de remplir et d'acheminer la présente formule.

A. AIRCRAFT IDENTIFICATION — IDENTIFICATION DE L'AÉRONEF

1. Owner - Propriétaire

2. Address - Adresse

3. Aircraft Manufacturer - Constructeur de l'aéronef	4. Model - Modèle	5. Serial Number - Numéro de série	6. Nationality and Registration Marks Marques de nationalité et d'immatriculation
Robinson	R44		

B. FLIGHT PERMIT REQUESTED - *Check applicable boxes* — PERMIS DE VOL DEMANDÉ - *Cocher la ou les case(s) voulue(s)*

1. ☐ Experimental Flight Permit
Permis de vol expérimental

2. ☐ Specific Purpose Flight Permit
Permis de vol à une fin spécifique

(a) ☐ Ferry Flight
Vol de convoyage

(b) ☐ Importation or Exportation Flight
Vol à l'importation ou à l'exportation

(c) ☐ Demonstration, Market Survey or Crew Training
Vol de démonstration, étude de marché ou formation d'équipage

(d) ☒ Flight Test following repair, modification or maintenance
Essais en vol après réparation, modification ou maintenance

(e) ☐ Other purpose (Specify)
Autre fin (Préciser)

C. FLIGHT DESCRIPTION AND AIRCRAFT LIMITATIONS — DESCRIPTION DU VOL ET LIMITATIONS DE L'AÉRONEF
Description of Flight(s) *Use attachment when appropriate* — Description du ou des vol(s) Joindre une feuille au besoin

1. From - Aérodrome de départ	2. To - Aérodrome de destination	
Campbell River (YBL)	Campbell River (YBL)	
3. Via - Escales	4. Date	5. Duration - Durée
	27 January 2006	90 days

6. Aircraft does not meet the applicable airworthiness requirements as follows: - Raisons pour lesquelles l'aéronef ne satisfait pas aux exigences de navigabilité en vigueur:

Mirror installed in accordance with AERO Design Ltd. drawing 64901.

7. The following restrictions are considered necessary for safe operations: - Les restrictions suivantes sont nécessaires pour la conduite des vols en toute sécurité:

- Occupants limited to persons involved with flight test program
- No flight over built up areas
- Day VFR conditions
- Vne = 143 KIAS (1.1 x Vne in RFM)
- Log book entry stating that the installation was performed in accordance with the drawings listed in section 6., signed by an AME

D. CERTIFICATION

I hereby certify that the aircraft described above is in a condition for safe operation.

Je, soussigné, certifie que l'aéronef décrit ci-dessus est en bon état de vol.

Signature	Date (Y-A - M - D-J)	
		☐ Registered Owner as shown on the Certificate of Registration Propriétaire enregistré selon le certificat d'immatriculation ☐ Authorized Representative Représentant autorisé

Canada

Jeff Clarke

From: Oucharek, Gregory [OUCHARG@tc.gc.ca]
Sent: Wednesday, January 25, 2006 2:59 PM
To: jeff@aerodesign.ca
Subject: RE: R22 Bear Paws

Jeff,

Last time around Flight Test elected to retain authority for related paragraphs and authorized approval upon review of the test report ... this may happen again and if so I will sign off where delegation has been requested but it is their call. Not a problem either way.

Greg

> -----Original Message-----
> **From:** Jeff Clarke [mailto:jeff@aerodesign.ca]
> **Sent:** Wednesday, January 25, 2006 2:49 PM
> **To:** Oucharek, Gregory
> **Subject:** R22 Bear Paws
>
> Greg,
>
> Please find attached revised compliance program CP640 (Rev. 2) to add the R22 references. Also attached is the proposed ICA and MSI 53 Appendix A. I will try to get the Mirror ICA/MSI 53 together tomorrow. Please advise if you have any questions or concerns.
>
> Jeff

MODIFICATION APPROVAL REQUEST APPLICATION FORM

MOD640, Rev. 1

1. NAME AND ADDRESS OF APPLICANT:	2. IDENTIFICATION OF PRODUCT	
AERO Design Ltd. 2013 39th Avenue N.E. Calgary, AB, T2E 6R7	MAKE: Robinson	MODEL: R22, all variants
ALL CORRESPONDANCE TO: AERO Design Ltd. 2013 39th Ave N.E. Calgary, AB T2E 6R7	SERIAL No.:	REGISTRATION:

3. REQUEST FOR:

A. SUPPLEMENTAL TYPE CERTIFICATE (STC)	☐	
B. STC/STA REVISION	☒	STC/STA No. SH05-17
C. LIMITED SUPPLEMENTAL TYPE CERTIFICATE (LSTC)	☐	
D. LIMITED STC/STA REVISION	☐	LSTC/LSTA No.
E. F.A.A. SUPPLEMENTAL TYPE CERTIFICATE	☐	
F. F.A.A. STC REVISION	☐	STC No.
G. FAMILIARIZATION OF F.A.A. STC	☐	STC No.
H. REPAIR DESIGN APPROVAL (RDC)	☐	
I. PARTS DESIGN APPROVAL (PDA)	☐	

4. TITLE OF MODIFICATION OR REPAIR:
Bear Paws Installation

5. BRIEF DESCRIPTION OF MODIFICATION OR REPAIR:
Installation of bear paws on the skid tubes fabricated from aluminum sheet. Revision is to add R22 configuration.

6. APPLICABLE TYPE APPROVAL (TA) OR TYPE CERTIFICATE (TC) DOCUMENTS:
A. TA NO. _____ B. TC No. H10WE C. OTHER _____

7. PROPOSED BASIS OF APPROVAL:
A. SAME AS TA ☐ B. SAME AS TC ☐ C. OTHER ☒ (Please specify) FAR 27, amdt 27-24

8. DOCUMENTATION CHECKLIST	REQUIRED		FOR DOT USE ONLY		
			RECEIVED		
	YES	NO	YES	NO	DATE
COMPLIANCE PROGRAM	✓*	X	✓		
MASTER DRAWING LIST	X				
FLIGHT MANUAL SUPPLEMENT		X			
MAINTENANCE MANUAL SUPPLEMENT		X			
INSTRUCTIONS FOR CONTINUING AIRWORTHINESS		X			
ENGINEERING REPORTS	X				
DESIGN DRAWINGS		X			
MANUFACTURE DRAWINGS & INSTALLATION INSTRUCTIONS	X				
ELECTRICAL LOAD ANALYSIS		X			
DRAFT STC, LSTC OR RDA		X			
WEIGHT AND MOMENT CHANGE	X				
FLIGHT TEST DATA	X				
OTHER (Specify)					

9. APPLICANT'S REMARKS:
Compliance program not changed from R44 configuration. * PLS REVISE TO INDICATE R22 (HIGHER AMDT LEVEL UNDERSTOOD)

RECEIVED 2006-01-25

10. In addition to the payment of Aircraft Certification approval fees as prescribed in Canadian Aviation Regulations (CAR) Section 104, I agree to reimburse Transport Canada incremental expenses as in Aviation Regulation Directive No. 3, or equivalent, as applicable. For further details governing cost recovery, refer to AARA 61.94.

PER: _____ Consultant 23 January, 2006
SIGNATURE OF APPLICANT TITLE DATE

11. _____ C-06-0084 2006-01-25
SIGNATURE OF REGIONAL ENGINEER DATE

Form MOD, 25 March 2001

Steven Fahey

From: "E. Burgoin" <ted@aerodesign.ca>
To: <steve@aerodesign.ca>
Sent: January 25, 2006 12:51 PM
Subject: Fw: R22 Bear Paw / Cargo Mirror

----- Original Message -----
From: Oucharek, Gregory
To: E. Burgoin
Sent: Wednesday, January 25, 2006 11:46 AM
Subject: RE: R22 Bear Paw / Cargo Mirror

Thanks. Serge is reviewing and will get back to me.

One thing I do not have in my collection is a revision of CP640 to include the R22 ... not a big deal since the applicable standards will not change but one more piece of paper on the too do list.

Greg

> -----Original Message-----
> **From:** E. Burgoin [mailto:ted@aerodesign.ca]
> **Sent:** Wednesday, January 25, 2006 11:10 AM
> **To:** Oucharek, Gregory
> **Subject:** Re: R22 Bear Paw / Cargo Mirror
>
> We will fly them as seperate tests since they will be seperate STC's. This is the requirement. As with any STC though it is up to the installer to determine that there is no incompatability with any other modification.
>
> From my experience with this kind of thing we are concerned with vibration and this is what I am mainly checking for. We are doing the rest of the flight test because of the regulatory requirement to "go through the motions" but realistically I am not expecting to find any change from the basic configuration.
>
> If things work out time wise I will also probably fly them together simply because the opportunity is there to do it. Again, the point of interest will be the vibration characteristics, but if we are up doing this I will spend the extra half hour to go through the whole program.
>
> Are we just about good to go on this? As soon as your cohorts are out of here I need to be doing this. E & B has a new R22 to deliver with the bear paws on it, probably in about a week and a half.
>
> Thanks Greg.
>
> Ted.

> ----- Original Message -----
> **From:** Oucharek, Gregory
> **To:** E. Burgoin (E-mail)
> **Cc:** Jeff Clarke (E-mail)
> **Sent:** Wednesday, January 25, 2006 10:40 AM
> **Subject:** R22 Bear Paw / Cargo Mirror
>
> Ted,
>
> One further point of clarification, are you planning to fly the mirror concurrently with the bear paws or are these two distinct

tests as published (FTP649 vs FT[redacted]40).

Thanks for cleaning up the CP. I will continue working with Serge for acceptance but would like a response to my question.

Regards,

Greg Oucharek, P. Eng
Transport Canada Civil Aviation
Senior Engineer, Aircraft Certification
Prairie & Northern Region,
Calgary, Alberta
(403) 292-4990

AERO DESIGN LTD.
2013 – 39 Avenue N.E., Calgary, Alberta, T2E 6R7

Tel: 403-250-8027
Fax: 403-250-8333
aerodesign@telusplanet.net

FAXED
23 JAN 2006

23 January, 2006

Transport Canada
Aircraft Certification Division
800-1601 Airport Road
Calgary, Alberta
T2E 6Z8

Attn: Greg Oucharek

Your File : C-05-0255, C-06-0052
Our File : 640, 649

Re: Robinson R22/R44 Bear Paws and Cargo Mirror

Greg,

Please find attached the following documents related to this project:

Bear Paws: Modification Approval Request Application Form	MOD640	Revision 1
Cargo Mirror Compliance Program	CP649	Revision 1

Please extend my delegation to include the following paragraphs of FAR 27 as listed on compliance program CP649, revision 1:
27.45 Performance – General
27.51 Takeoff
27.65 Climb: All Engines Operating
27.67 Climb: One Engine Inoperative
27.73 Performance at Minimum Operating Speed
27.75 Landing
27.79 Limiting Height-Speed Envelope
27.141 Flight Characteristics – General
27.143 Controllability and Maneuverability
27.161 Trim Control
27.171 Stability: General
27.173 Static Longitudinal Stability
27.175 Demonstration of Static Longitudinal Stability
27.251 Vibration
27.629 Flutter

Regards,

E. Burgoin, P.Eng, DAR 290M

Encl.

MODIFICATION APPROVAL REQUEST APPLICATION FORM

MOD640, Rev. 1

1. NAME AND ADDRESS OF APPLICANT:

AERO Design Ltd.
2013 39th Avenue N.E.
Calgary, AB, T2E 6R7

2. IDENTIFICATION OF PRODUCT

MAKE:	MODEL:
Robinson	R22, all variants

ALL CORRESPONDANCE TO:
AERO Design Ltd.
2013 39th Ave N.E.
Calgary, AB T2E 6R7

SERIAL No.:	REGISTRATION:

3. REQUEST FOR:

A.	SUPPLEMENTAL TYPE CERTIFICATE (STC)	☐	
B.	STC/STA REVISION	☒	STC/STA No. SH05-17
C.	LIMITED SUPPLEMENTAL TYPE CERTIFICATE (LSTC)	☐	
D.	LIMITED STC/STA REVISION	☐	LSTC/LSTA No.
E.	F.A.A. SUPPLEMENTAL TYPE CERTIFICATE	☐	
F.	F.A.A. STC REVISION	☐	STC No.
G.	FAMILIARIZATION OF F.A.A. STC	☐	STC No.
H.	REPAIR DESIGN APPROVAL (RDC)	☐	
I.	PARTS DESIGN APPROVAL (PDA)	☐	

4. TITLE OF MODIFICATION OR REPAIR:

Bear Paws Installation

5. BRIEF DESCRIPTION OF MODIFICATION OR REPAIR:

Installation of bear paws on the skid tubes fabricated from aluminum sheet. Revision is to add R22 configuration.

6. APPLICABLE TYPE APPROVAL (TA) OR TYPE CERTIFICATE (TC) DOCUMENTS:

A. TA NO. _____ B. TC No. H10WE _____ C. OTHER _____

7. PROPOSED BASIS OF APPROVAL:

A. SAME AS TA ☐ B. SAME AS TC ☐ C. OTHER ☒ (Please specify) FAR 27, amdt 27-24

8. DOCUMENTATION CHECKLIST	REQUIRED		FOR DOT USE ONLY		
			RECEIVED		
	YES	NO	YES	NO	DATE
COMPLIANCE PROGRAM		X			
MASTER DRAWING LIST	X				
FLIGHT MANUAL SUPPLEMENT		X			
MAINTENANCE MANUAL SUPPLEMENT		X			
INSTRUCTIONS FOR CONTINUING AIRWORTHINESS		X			
ENGINEERING REPORTS	X				
DESIGN DRAWINGS		X			
MANUFACTURE DRAWINGS & INSTALLATION INSTRUCTIONS	X				
ELECTRICAL LOAD ANALYSIS		X			
DRAFT STC, LSTC OR RDA		X			
WEIGHT AND MOMENT CHANGE	X				
FLIGHT TEST DATA	X				
OTHER (Specify)					

9. APPLICANT'S REMARKS:

Compliance program not changed from R44 configuration.

10. In addition to the payment of Aircraft Certification approval fees as prescribed in Canadian Aviation Regulations (CAR) Section 104, I agree to reimburse Transport Canada incremental expenses as in Aviation Regulation Directive No. 3, or equivalent, as applicable. For further details governing cost recovery, refer to AMA 513/4.

PER: _____ Consultant _____ 23 January, 2006

SIGNATURE OF APPLICANTS — TITLE — DATE

11.

_____ _____

SIGNATURE OF REGIONAL ENGINEER — DATE

Transport Canada
Transports Canada

Current Information, directly from the Official Canadian Civil Aircraft Register database.

Mark	C-FEHD	*Serial No*	10692
Common Name	Robinson	*Model*	R44 II
Base Of Op. - Country	CANADA		
Base Of Op. - Province	Alberta		
Base Of Op. - Location	Grand Prairie		
File Location	Edmonton	*Basis for Eligibility for Registration*	Type Certificate - H97
Type of Registration	Commercial		
Category	Helicopter	*Weight (Kgs)*	1133.98
Manufacturer	Robinson		
Year of Manufacture	2005	*Year Imported*	2005
Country of Manufacture	U.S.A.		

Owner Registration

Owner Registered Since	2005-04-06	*Last Certificate of Registration Issued*	2005-04-06
Engine	Piston	*Number of Engines*	1

Owner Information

Name (1 of 1)	Remote Air Operators Inc.	*Mail Recipient*	Yes
Address	Box 31, 9909-102 Street		
City	Grande Prairie	*Province*	Alberta
Postal Code	T8V 2V4	*Region*	Prairie and Northern

Transport Canada
Transports Canada

Current Information, directly from the Official Canadian Civil Aircraft Register database.

Mark	C-GOHL	*Serial No*	10693
Common Name	Robinson	*Model*	R44 II
Base Of Op. - Country	CANADA		
Base Of Op. - Province	British Columbia		
Base Of Op. - Location	Kelowna		
File Location	Vancouver	*Basis for Eligibility for Registration*	Type Certificate - H97
Type of Registration	Commercial		
Category	Helicopter	*Weight (Kgs)*	1133.98
Manufacturer	Robinson		
Year of Manufacture	2005	*Year Imported*	2005
Country of Manufacture	U.S.A.		

Owner Registration

Owner Registered Since	2005-04-05	*Last Certificate of Registration Issued*	2005-04-05
Engine	Piston	*Number of Engines*	1

Owner Information

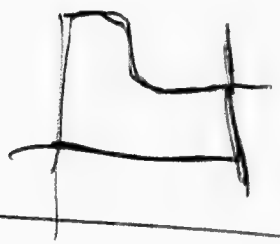
Name (1 of 1)	Okanagan Mountain Helicopters FTU Ltd.	*Mail Recipient*	Yes
Address	PO Box 30012	RPO Glenmore	
City	Kelowna	*Province*	British Columbia
Postal Code	V1V 2M4	*Region*	Pacific

Wiki

→ Remote
Okanagan Mtn Helicopters Ltd

10693 C-GOHL
10692 C-FEHD

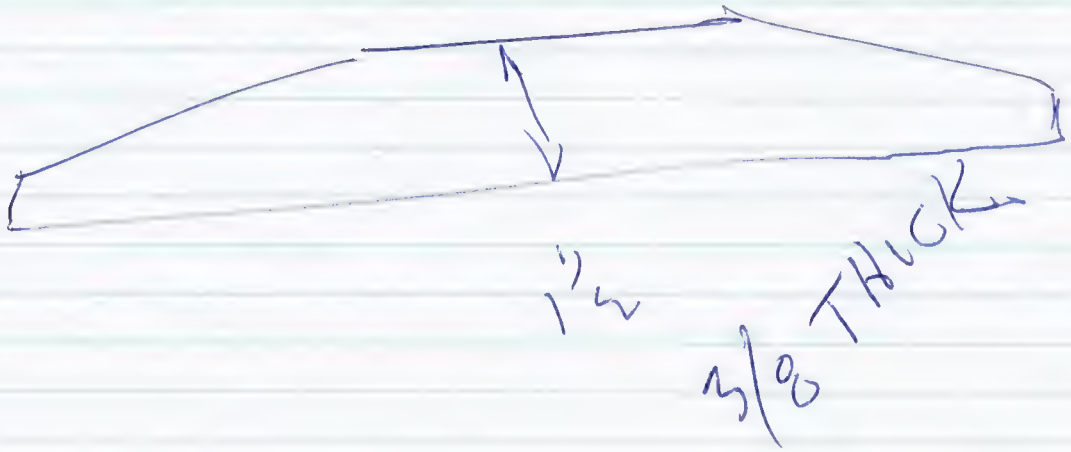
NOT IN REGISTRY YET.



4 m

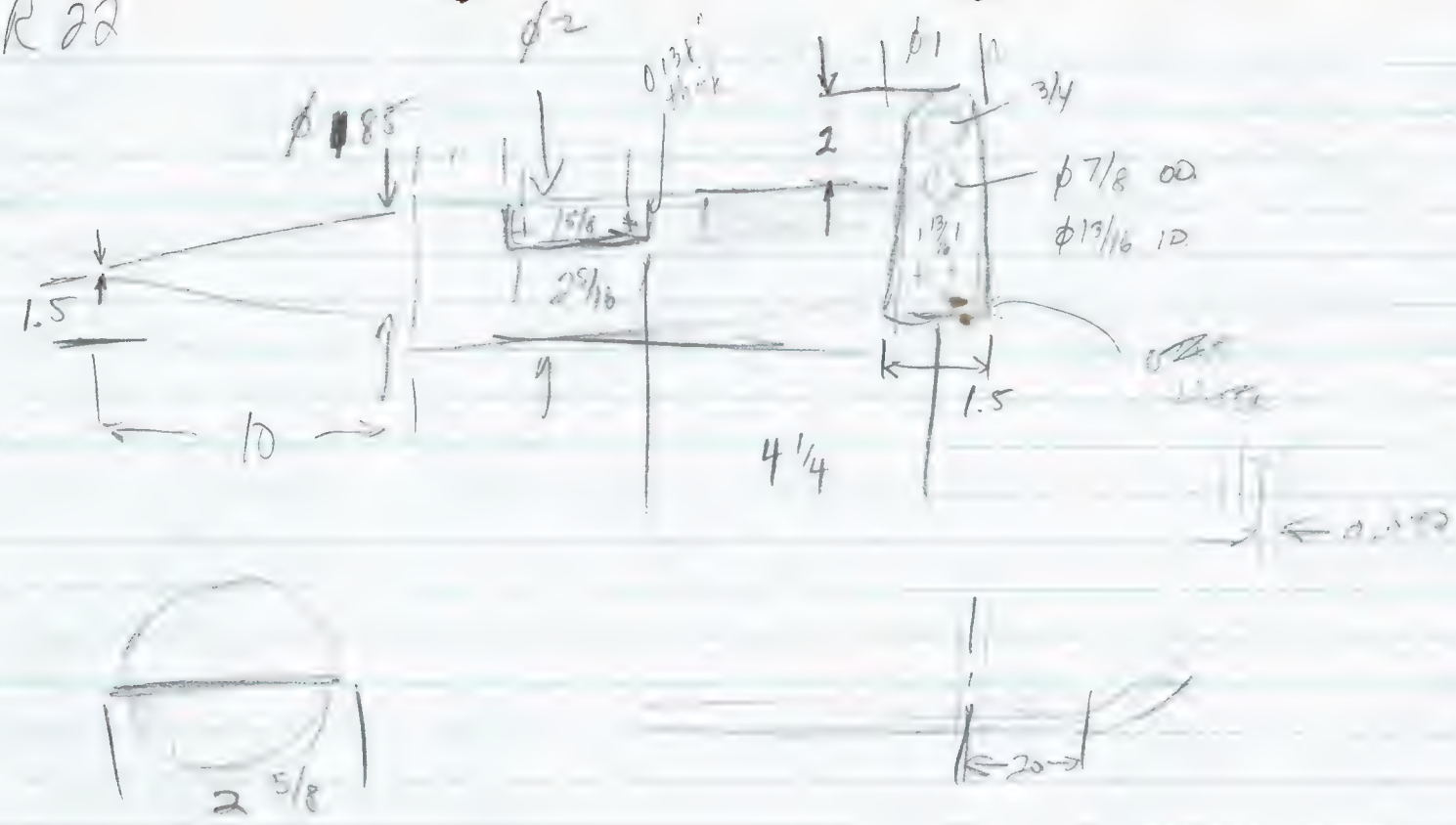
R44

BEAR PAW

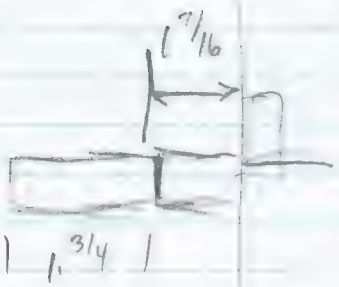


R22 BEAR PAW.

R 22



WHEEL
10 × 3.5 - 4



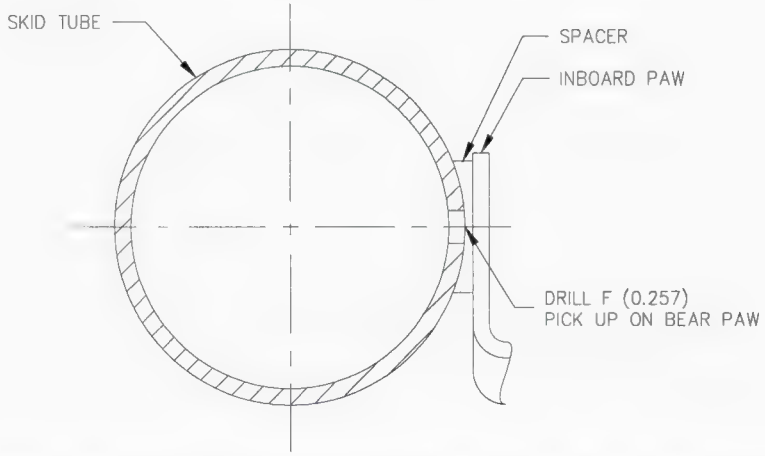
1.5" OFFSET FROM SHAFT TO ℄ OF WHEEL

1 1/8 clearance from face to face

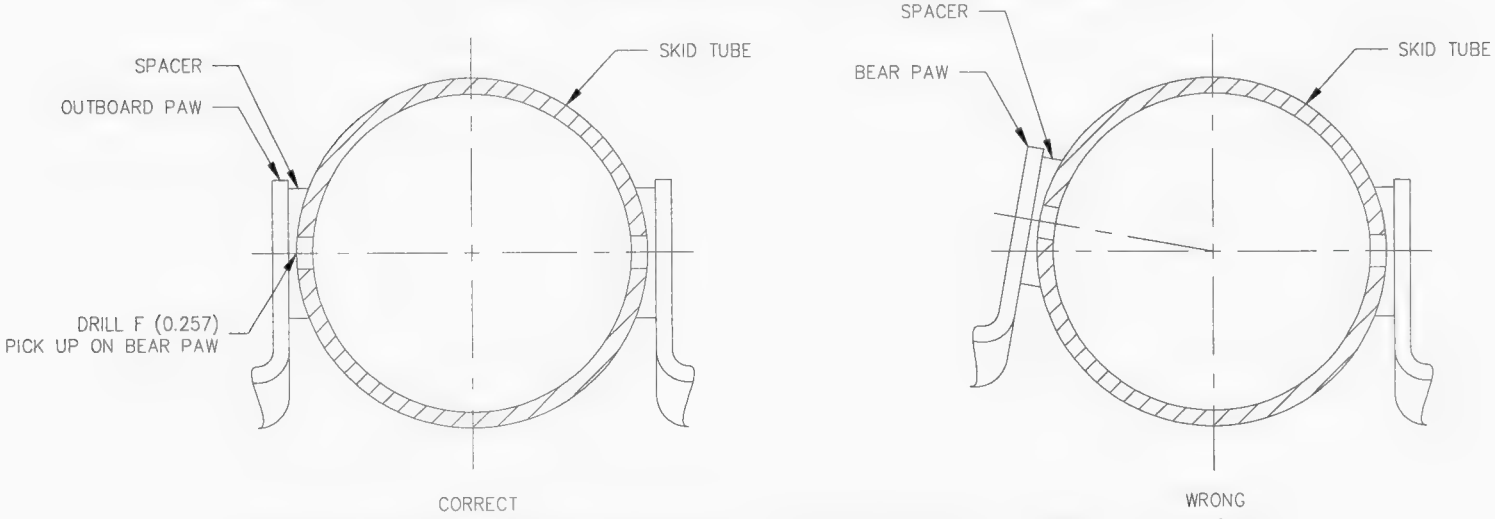
Instructions for Installing AERO Design Ltd. Bear Paws

Refer to drawing 64001.

1. Drill #9 (0.196) hole in aft end of skid tube as indicated.
2. Mount strap (P/N 64021-01) to bottom side of skid tube using AN3-7A or -10A bolt, AN960-10 washers, and MS21044N3 nut. Do not fully tighten nut, strap must be free to rotate as required.
3. Position inboard paw so that cross tube saddle is centered in slot in bear paw.
4. Locate forward spacer (thin, P/N 64021-02) between inboard paw and cross tube.
5. Drill F (0.257) through forward hole into skid tube, using inboard bear paw as a guide. Drill through first side only. Hole to be located on centre of skid tube.

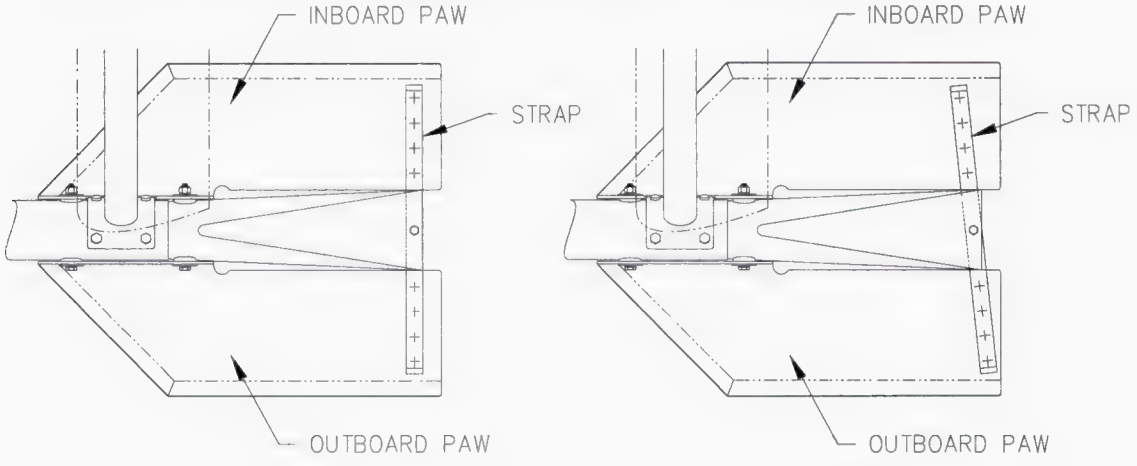


6. Position outboard paw on skid tube. Align aft edge of outboard paw with aft edge of inboard paw.
7. Locate forward spacer (thin, P/N 64021-02) between outboard paw and cross tube.
8. Drill F (0.257) through forward hole into skid tube, using outboard bear paw as a guide. Hole to be located on centre of skid tube, in line with inboard hole.



9. Mount forward end of bear paws using one AN4-36A bolt, AN960-416 washers, AN970-4 washers, and MS21044N4 nut through forward hole. Torque bolt until paws and spacers are tight against skid tube. Do not exceed 50 in-lbs.

10. Clamp aft end of paws to strap. Ensure strap is positioned parallel to aft edges of bear paws.
    Note: Aft end of skid tube may not be cut straight. Aligning strap with aft edge of skid tube may result in misalignment of the strap on the bear paws.



11. Torque AN3 bolt to prevent rotation of the strap. Do not exceed 20 in-lbs.
12. Insert aft spacers (thick, P/N 64021-03).
13. Drill F (0.257) through aft holes into skid tube, using bear paws as a guide. Holes to be located on centre of tube, and in line with each other.
    Note: Aft section of skid tube has a slot in centre on the sides that is filled with sealant.
14. Install one AN4-36A bolt, AN960-416 washers, AN970-4 washers, and MS21044N4 nut in mounting hole. Torque bolt until paws and spacers are tight against skid tube. Do not exceed 50 in-lbs.
15. Pilot drill #41 (0.096) in paws, locate from strap. Cleco each hole after it is drilled.
16. Remove paws and strap from skid tube.
17. Drill out pilot holes to #21 (0.159). Cleco each hole after it is drilled. Countersink bottom side of paw 100°, to match MS20426AD5 rivet.
18. De-burr holes.
19. Rivet strap to paws with MS20426AD5 rivets.
20. Position paw assembly on skid tube.
21. Insert spacers.
22. Install two AN4-36A bolts, AN960-416 washers, AN970-4 washers, and MS21044N4 nuts. Torque AN4 bolts to 50 in-lbs. Ensure skid tube is not deformed.
23. Install one AN3-7A or -10A bolt, AN960-10 washers, and MS21044N3 nut. Torque AN3 bolt to 20 in-lbs.

AERO **DESIGN LTD.**
2013 – 39th Ave N. E., Calgary, Alberta, T2E 6R7 aerodesign@telusplanet.net

F A X C O V E R S H E E T

DATE:	April 14, 2005	**TIME:**	3:54 PM
TO:	**Ed Wilcock**	**PHONE:**	250-287-4421
	E&B Helicopters	**FAX:**	250-287-4352
FROM:	J. Clarke Aero Design Ltd.	**PHONE:** **FAX:**	403-250-8027 403-250-8333

Number of pages including cover sheet: 3

RE: ROBINSON R44 BEAR PAWS

Ed,

Please find attached a copy of the STC for installing the Bear Paws. Clean copies will follow by mail.

Jeff Clarke -

Jeff

Aero Design

From: "Massicotte, Serge" <MASSICS@tc.gc.ca>
To: "Oucharek, Gregory" <OUCHARG@tc.gc.ca>
Cc: "Ted Burgoin (E-mail)" <ted.aerodesign@telusplanet.net>
Sent: April 14, 2005 9:59 AM
Subject: RE: Robinson R44 - Revised CP and Flight Test Program

Hi Greg,

I reviewed subject flight test report and find it acceptable. As expected, looks like the Bear Paws did not have any substantial effects on performance and general flight characteristics. It is usually required to record the full control throws (lat. and long.) in order to properly assess control margins but in this case, I am not worried as control positions were very similar to the baseline aircraft.

How do you want to proceed with the finding of compliance for the "Flight" paragraphs? Do I need to personally sign-off the CP or can you do it based on this email? Let me know.

Serge Massicotte
Engineering Test Pilot
Aircrat Certification - Transport Canada
(613)941-6212

-----Original Message-----
From: E. Burgoin [mailto:ted.aerodesign@telusplanet.net]
Sent: Tuesday, April 12, 2005 12:46 PM
To: Massicotte, Serge
Subject: Re: Robinson R44 - Revised CP and Flight Test Program

Serge:

Sorry didn't get this e-mail until I got back in the office yesterday.

Flew the helicopter on Thursday of last week, 07 April.

Attached are:
- the flight test results in Appendix A
- the weight and balance in Appendix B.

We flew at a weight of 2,200 lb. which is the limit for the higher speed of 130kts.

Ed could not tell any difference in flight characteristics between the installation and non-installation configurations.

Landing in the swamp was interesting.

Please advise.

Ted.

> ----- Original Message -----
> **From:** Massicotte, Serge
> **To:** E. Burgoin
> **Cc:** Oucharek, Gregory
> **Sent:** Thursday, April 07, 2005 1:23 PM
> **Subject:** RE: Robinson R44 - Revised CP and Flight Test Program

Proposed testing is acceptable. Make sure you'll have enough data (long. cyclic pos.) at various speeds during autorotation to compare and identify any effect of the mod on control positions. Three or four speeds should be fine as long as the same Nr/collective position is used. Also, I was hoping to see some test cards with specific test points before you get in the chopper.

Serge.

-----Original Message-----
From: E. Burgoin [mailto:ted.aerodesign@telusplanet.net]
Sent: Wednesday, April 06, 2005 1:27 PM
To: Massicotte, Serge
Subject: Robinson R44 - Revised CP and Flight Test Program

Serge:

Attachments

AERO **DESIGN LTD.**
2013 – 39th Ave N. E., Calgary, Alberta, T2E 6R7 aerodesign@telusplanet.net

F A X C O V E R S H E E T

DATE:	April 13, 2005	**TIME:**	9:22 AM
TO:	**Greg Oucharek**	**PHONE:**	403-292-4990
	Transport Canada	**FAX:**	403-292-4992
FROM:	J. Clarke Aero Design Ltd.	**PHONE:** **FAX:**	403-250-8027 403-250-8333

Number of pages including cover sheet: 3

RE: R44 BEAR PAWS

Greg,

Please find attached the compliance program with the delegated sections initialed by Ted as requested.

Jeff Clarke

Jeff

AIRWORTHINESS REQUIREMENTS COMPLIANCE PROGRAM

APPLICANT: AERO Design Ltd.
2013 - 39th Ave N.E.
Calgary, Alberta, T2E 6R7

CORRESPONDANCE TO: AERO Design Ltd.
(If other than applicant) 2013 - 39th Ave N.E.
Calgary, Alberta, T2E 6R7

DATE: 04 February, 2005
REV. No. 1 04 April, 2005

MAKE: Robinson
MODEL: R44

REGISTRATION: All eligible
SERIAL No.: All eligible

NATURE OF WORK: Bear Paws Installation

MODEL CERTIFICATION BASIS: FAR 27, 1 February, 1965, including amendments 27-1 thru 27-24
MODIFICATION CERTIFICATION BASIS: FAR 27, 1 February, 1965, including amendments 27-1 thru 27-24

Airworthiness Requirement	Subject for Compliance or Documentary Proof	Form of Substantiation	DOT	DAR	Comments
Subpart B	**Flight**				
27.51(a)(1)	Takeoff	Flight test	X		
27.65	Climb: All Engines Operating	Flight test	X		
27.75(a)(1)	Landing	Flight test	X		
27.141	General	Flight test	X		
27.143	Controllability and maneuverability	Flight test	X		Flight Test in accordance with TR640.02
27.171	Stability: General	Flight test	X		
27.173	Static Longitudinal Stability	Flight test	X		Flight test witness will be done by DAR 290M
27.175	Demonstration of Static Long. Stability	Flight test	X		
27.177	Static Directional Stability	Flight test	X		
27.231	General	Flight Test	X		
27.251	Vibration	Flight test	X		
Subpart C	**Strength Requirements**				
27.301	Loads	Analysis		X	
27.303	Factor of Safety	Analysis		X	
27.305	Strength and Deformation	Analysis		X	
27.307	Proof of Structure	Analysis		X	
27.309	Design Limitations	Flight test		X	Flight Test in accordance with TR640.02
Subpart D	**Design and Construction**				
27.601	Design	Design		X	
27.603	Materials	Specification on drawings		X	
27.607	Fasteners	Specification on drawings		X	
27.629	Flutter	Flight Test		X	Flight Test in accordance with TR640.02
27.773(a)(2)	Pilot Compartment View - Reflections	Specification on drawings		X	Part to be painted matte black

Airworthiness Requirement	Subject for Compliance or Documentary Proof	Form of Substantiation	DOT	DAR	Comments
Subpart G	**Operating Limitations and Information**				
27.1505	Never-Exceed Speed	Flight Test		X	Flight Test in accordance with TR640.02
27.1529	Instructions for Continued Airworthiness	ICA provided	X		

AERO DESIGN LTD.
2013 – 39 Avenue N.E., Calgary, Alberta, T2E 6R7

Tel: 403-250-8027
Fax: 403-250-8333
aerodesign@telusplanet.net

12 April, 2005

Transport Canada
Aircraft Certification Division
800-1601 Airport Road
Calgary, Alberta
T2E 6Z8

Attn: Greg Oucharek

Your File : C-05-0255
Our File : 640

Re: Robinson R44 Bear Paws

Greg,

Please find attached the following documents related to this project:

Document Control List	DCL640	Revision 0
AE 100 Form	AE640	Revision 0
Conformity Inspection Record		
Engineering Report	ER640.01	Revision 0
Flight Test Plan	FTP640.02	Revision 1
Drawings		
Bear Paws Installation	64001	Revision 0
Bear Paws Assembly	64010	Revision 0
Paw Fabrication	64020, Sht. 1/2	Revision 0
Paw Fabrication	64020, Sht. 2/2	Revision 0
Parts Fabrication	64021	Revision 0

Regards,

E. Burgoin, P.Eng, DAR 290M

Encl.

FORM AE-100

DEPARTMENT OF TRANSPORT STATEMENT OF COMPLIANCE OF AIRCRAFT OR AIRCRAFT COMPONENTS WITH THE AIRWORTHINESS REQUIREMENTS		AE-100 No.:	AE640
		Initial Issue Date:	12 April, 2005
		Revision:	0
		Revision Date:	
Aircraft Mfgr: Robinson Aircraft Model: R44, R44 II Registration: AIII Eligible	Model Type Airplane ☐ Helicopter ☒ Appliance ☐ Component ☐	Approval No.:	SH05-17
		Delegation No.:	290M
		Delegate Name:	E. Burgoin
		Classification of Designee:	
		Employer:	*AERO* Design Ltd.

LIST OF APPROVED REPORTS AND DATA

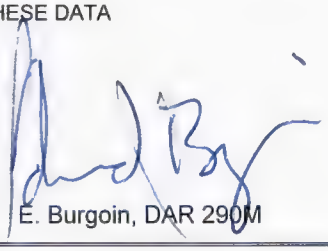
Document Number		Document Title	Compliance Status
DCL640	Revision 0	Document Control List and all documents referred to therein	
ER640.01	Revision 0	Engineering Report	
64001	Revision 0	Bear Paws Installation	
64010	Revision 0	Paw Assembly	
64020, Sht. 1/2	Revision 0	Paw Fabrication	
64020, Sht. 2/2	Revision 0	Paw Fabrication	
64021	Revision 0	Parts Fabrication	
		DATA APPROVED BY TRANSPORT CANADA	
FTP640.02	Revision 1	Flight Test Plan	
ICA640.90	Revision 0	Instructions for Continued Airworthiness	

CERTIFICATION

UNDER THE AUTHORITY VESTED IN ME BY THE DEPARTMENT OF TRANSPORT, I HEREBY CERTIFY THAT THE DATA LISTED ABOVE AND ON THE ATTACHED SHEETS NUMBERED Nil HAVE BEEN EXAMINED IN ACCORDANCE WITH ESTABLISHED PROCEDURES AND FOUND TO COMPLY, TO THE BEST OF MY KNOWLEDGE AND BELIEF WITH THE PERTINENT COMPLIANCE REQUIRMENTS.

I THEREFORE [☐] RECOMMEND FOR APPROVAL OF THESE DATA

[☒] APPROVE THESE DATA



E. Burgoin, DAR 290M

CONFORMITY INSPECTION RECORD

Applicant	Aeronautical Product				Title of Change
	Make	Model	Serial No.	Region	BEAR PAW INSTALLATION
	ROBINSON	R44	1069 & FEHS		

Drawing No.	Applicant's Inspector Signature	Applicant's Inspector Date	T.C. Inspection Signature	T.C. Inspection Date	Findings
64001	[signature]	7APR05			

APPLICANT'S ATTESTATION

I hereby confirm that the prototype installation for the subject

☒ MODIFICATION,

☐ REPAIR,

☐ TSO/AP-TC ARTICLE

is in conformity with the applicable installation drawing(s) listed above and that necessary ground tests have been carried out.
[Please check (✓) the applicable box.]

Additional Information:

Signature: [signature] M792307

TC INSPECTION

☒ ACCEPTABLE

☐ UNACCEPTABLE

Remarks:

Signature: [signature]
DAR 290

AERO Design Ltd.

ENGINEERING REPORT
ER640.01

BEAR PAWS INSTALLATION

Robinson R44

Approved: E. Burgoin, P. Eng.

Prepared by: Jeff Clarke

Revision 0
Date: 16 February, 2005

AERO Design Ltd.
Engineering Consultants

2013 – 39th Avenue N.E., Calgary, Alberta T2E 6R7
Phone: (403) 250-8027
Fax: (403) 250-8333
E-Mail: aerodesign@telusplanet.net

TABLE OF CONTENTS

1.0 INTRODUCTION

"Bear paws" are pads installed on the skid tube in order to distribute the weight of the helicopter when landing on soft surfaces, such as snow. The pads in this installation are made of aluminum sheet, and are attached to using bolts where the aft cross tube joins the skid tube, and to the aft end of the skid tube.

2.0 REFERENCE

AERO Design Ltd. Drawing 64001

MIL-HDBK-5J

Memo from John Shapley of FAA, Regarding Bear Paw requirements (Appendix B)

3.0 BASIS OF CERTIFICATION

Robinson R44, R44 II, TCDS H-97

FAR 27, dated February 1, 1965, including amendments 27-1 thru 27-24.

This installation:

Same as the basis of certification shown above.

4.0 ANALYSIS OF CURRENT AIRWORTHINESS DIRECTIVES (AD'S)

There are no current AD's related to this project. See appendix A for a list of current AD's.

5.0 LOADS

The bear paw is made from 1/8" 6061-T6 Aluminum sheet. Using the memo from John Shapley of the FAA the following assumptions can be made:
a) 1g (limit) static loading at maximum gross weight and critical C of G.
b) assume equal load dstribution between the pads.
c) metallic pads are considered rigid, and a rectangular load distribution can be assumed.

$GW_{max} := 2500 \cdot lbf$ $CG_{aft\_max} := 98 \cdot in$ Max Gross weight and aft C of G limit

$FS_{cp} := 134.0 \cdot in$ Flight station of centre of pressure of pad

$FS_{fwd\_tip} := 50.6 \cdot in$ Flight station of forward edge of skid tube in contact with ground

$FS_{aft\_tip} := 140.1 \cdot in$ Flight station of aft edge of skid tube

The load is equally distributed between the left and right sides.

$D_{tube} := 2.71 \cdot in$ Diameter of skid tube

$$A_{tube} := \left(FS_{aft\_tip} - FS_{fwd\_tip}\right) \cdot D_{tube}$$

$A_{tube} = 242.5 \cdot in^2$ Planar area of skid tube

$A_{paw} := 179.5 \cdot in^2$ Planar area of entire bear paw

Assumptions:
a) Forward tip of the skid tube is rigidly supported (sitting on a solid object, eg. a rock or log)
b) Remainder of skid tube is supported on non-solid "swampy" material.
c) Ground reactions:
-point load at forward end of skid tube
-triangular load distribution over remainder of skid tube
-rectangular load distribution over bear paw, equal to max. distributed load on skid tube

Summing moments about the forward tip for one (1) skid tube:

$$w_{max} := \frac{\frac{GW_{max}}{2} \cdot \left(CG_{aft\_max} - FS_{fwd\_tip}\right)}{0.5 \cdot A_{tube} \cdot \frac{2}{3} \cdot \left(FS_{aft\_tip} - FS_{fwd\_tip}\right) + A_{paw} \cdot \left(FS_{cp} - FS_{fwd\_tip}\right)}$$

$w_{max} = 2.7 \cdot psi$ Maximum pressure

w_{max} is the maximum pressure for the triangular distribution on the skid tube, and the uniform pressure on the bear paw.

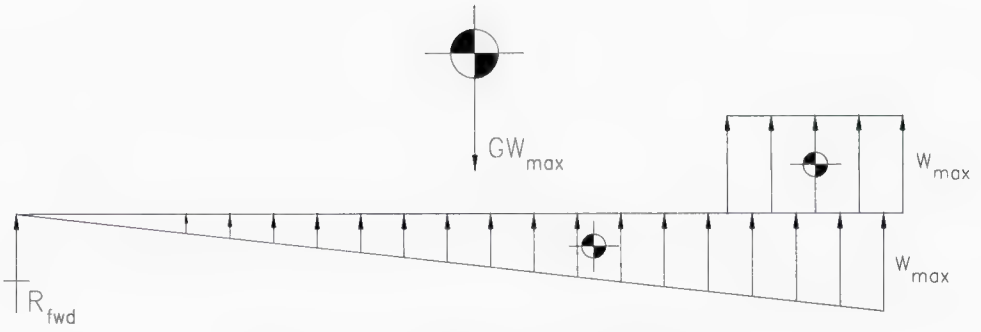


Figure 1 – Skid tube load distribution

Load on Bear Paws

$p_{paw} := w_{max} \cdot A_{paw}$

$p_{paw} = 479 \cdot lbf$ Load on paw

$p_{paw\_side} := \frac{p_{paw}}{2}$

$p_{paw\_side} = 239 \cdot lbf$ Load on each half of paw

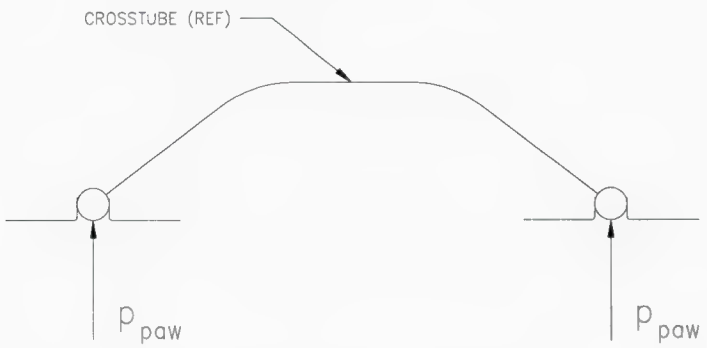


Figure 2 – Load Reactions

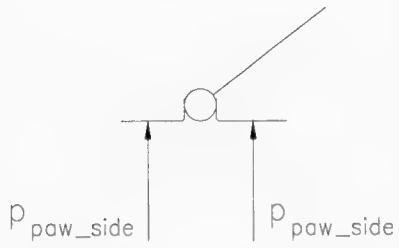


Figure 3 – Paw loads

6.0 STRUCTURAL COMPLIANCE

Determine the bending moment allowable of attachments, using Bruhn, chapter C3:

1) Bending on aft strap

Locate neutral axis

Assume 1" of effective paw material on either side of strap. Strap is 3/4" x 1/4".

$$y_{na} := \frac{2.75 \cdot in \cdot 0.125 \cdot in \cdot 0.0625 \cdot in + 0.75 \cdot in \cdot 0.25 \cdot in \cdot 0.25 \cdot in}{2.75 \cdot in \cdot 0.125 \cdot in + 0.75 \cdot in \cdot 0.25 \cdot in}$$

$y_{na} = 0.129 \cdot in$ Distance from bottom of sheet to neutral axis

Since the neutral axis is so close to the thickness of the sheet, the neutral axis is assumed to be located at the top edge of the sheet.

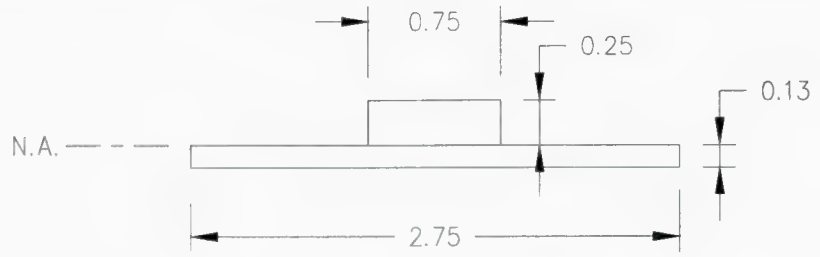


Figure 4 – Strap Section

$$I_1 := \frac{1}{12} \cdot 0.75 \cdot in \cdot (0.5 \cdot in)^3$$

$I_1 = 0.007813 \cdot in^4$ Moment of inertia of strap

$C_1 := 0.25 \cdot in$ Distance from centroid to outer edge

$F_{ty} := 36 \cdot ksi$ Yield tensile strength of 6061-T6 Aluminum (ref: MIL-HDBK-5J)

$$M_1 := \frac{F_{ty} \cdot \frac{I_1}{C_1}}{2}$$

$M_1 = 562.5 \cdot in \cdot lbf$ Allowable bending moment on strap

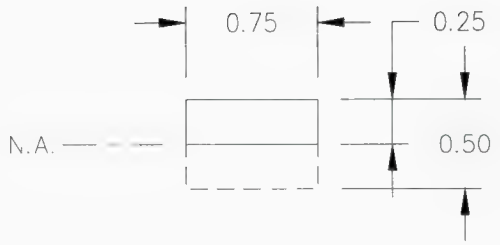


Figure 5 – Top Section of Strap

$I_2 := \frac{1}{12} \cdot 2.75 \cdot in \cdot (0.25 \cdot in)^3$

$I_2 = 0.003581 \cdot in^4$ Moment of inertia of effective sheet

$C_2 := 0.125 \cdot in$ Distance from centroid to outer edge

$$M_2 := \frac{F_{ty} \cdot \frac{I_2}{C_2}}{2}$$

$M_2 = 515.6 \cdot in \cdot lbf$ Allowable bending moment on effective sheet

Figure 6 – Bottom Section of Strap

$M_{a\_strap} := M_1 + M_2$

$M_{a\_strap} = 1078 \cdot in \cdot lbf$ Allowable bending moment on strap/sheet section

In order for the moments to be added, there must be sufficient rivets to transfer shear into the strap.

$Q := 0.75 \cdot in \cdot 0.25 \cdot in \cdot 0.125 \cdot in$

$Q = 0.023 \cdot in^3$ First moment of area of section above joint

$$I = \sum I_c + Ay^2$$

$$I := \left[\frac{1}{12} \cdot 0.75 \cdot in \cdot (0.25 \cdot in)^3\right] + (0.75 \cdot in \cdot 0.25 \cdot in) \cdot (0.125 \cdot in)^2 + \left[\frac{1}{12} \cdot 2.75 \cdot in \cdot (0.125 \cdot in)^3\right] + (2.75 \cdot in \cdot 0.125 \cdot in) \cdot (0.0625 \cdot in)^2$$

$I = 0.0057 \cdot in^4$ Moment of inertia of section

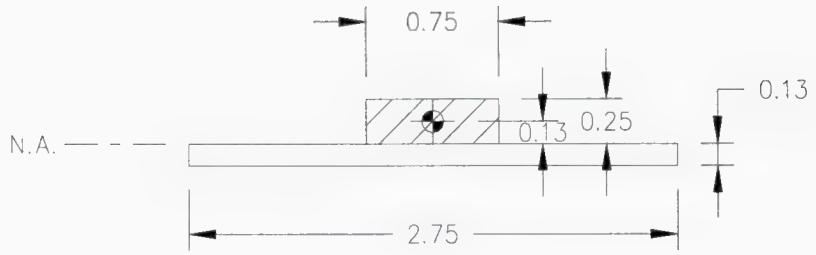


Figure 7 – Area Above Neutral Axis

The strap is attached to the paw with MS20426AD5 rivets. The rivet pitch is 1.125".

$$q := \frac{596 \cdot lbf}{1.125 \cdot in}$$

$q = 529.8 \cdot \frac{lbf}{in}$ Allowable running load on rivets

$$V_{allow} := \frac{q \cdot I}{Q}$$

$V_{allow} = 129 \cdot lbf$ Allowable shear on strap

Assuming half of the load on the paw is distributed to the strap, and the other half to the forward attachments:

$$V_{strap} := \frac{p_{paw\_side}}{2}$$

$V_{strap} = 120 \cdot lbf$ Shear applied to strap

$V_{allow} = 129 \cdot lbf$ Allowable shear

Margin of Safety $MS := \frac{V_{allow}}{V_{strap}} - 1$

$MS = 0.1$

MARGIN OF SAFETY IS POSITIVE

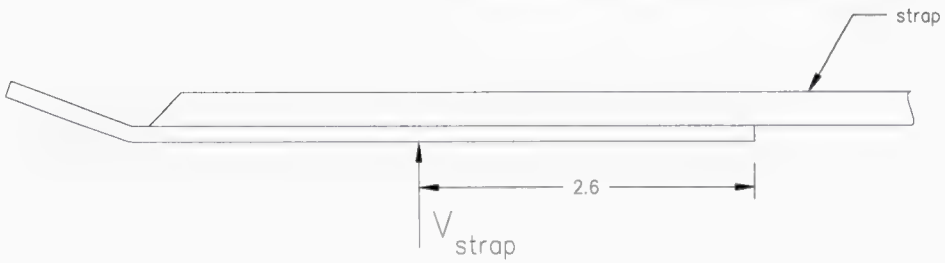


Figure 8 – Bending on Strap

$M_{strap} := V_{strap} \cdot 2.6 \cdot in$

$M_{strap} = 311 \cdot in \cdot lbf$ Bending moment on strap
(centre of pressure is 2.6" from inside edge of paw at the strap)

$M_{a\_strap} = 1078 \cdot in \cdot lbf$ Allowable bending moment on strap

Margin of Safety $MS := \frac{M_{a\_strap}}{M_{strap}} - 1$

$MS = 2.5$

MARGIN OF SAFETY IS POSITIVE

2) Bending at bolt attachments

Assuming a 2" effective width of sheet at each bolt:

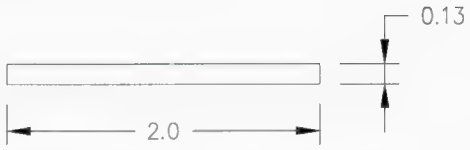


Figure 9 – Section at Bolt Attachment

$I := \frac{1}{12} \cdot 2 \cdot in \cdot (0.125 \cdot in)^3$

$I = 0.000326 \cdot in^4$ Moment of inertia of effective width

$C := 0.0625 \cdot in$ Distance from centroid to outer edge

$M_{allow} := 2 \cdot F_{ty} \cdot \frac{I}{C}$

$M_{allow} = 375 \cdot in \cdot lbf$ Allowable bending moment on forward bolted attachments
(2 attachments)

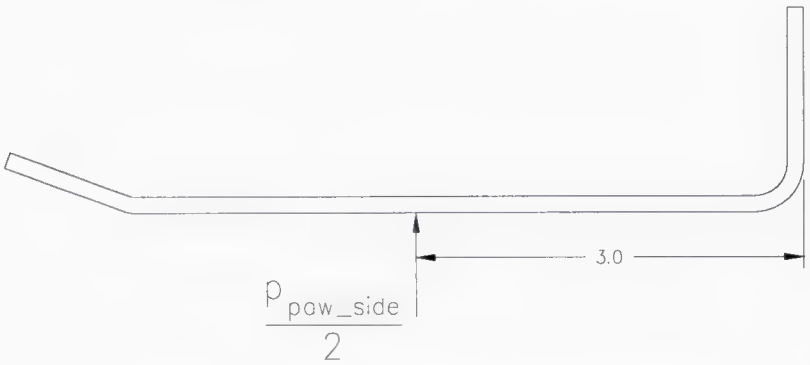


Figure 10 – Bending at Bolt Attachments

Assuming half the load is applied to the forward attachments:

$$M := \frac{p_{paw\_side}}{2} \cdot 3 \cdot in$$

$M = 359 \cdot in \cdot lbf$ Applied bending moment to forward attachments

Margin of Safety $MS := \frac{M_{allow}}{M} - 1$

$MS = 0.04$

MARGIN OF SAFETY IS POSITIVE

Note that the yield tensile strength has been used to ensure that the applied static load does not permanently deform the bear paw installation.

Attachment Bolts

The bear paws are attached to the landing gear with two (2) AN4 bolts at the forward end.

Assuming all of the load applied to the bear paw is resisted by one bolt:

$p_{paw\_side} = 239 \cdot lbf$ Load on bear paw (each side of skid tube)

$p_{s\_bolt} := p_{paw\_side}$

$p_{s\_bolt} = 239 \cdot lbf$ Shear on bolt

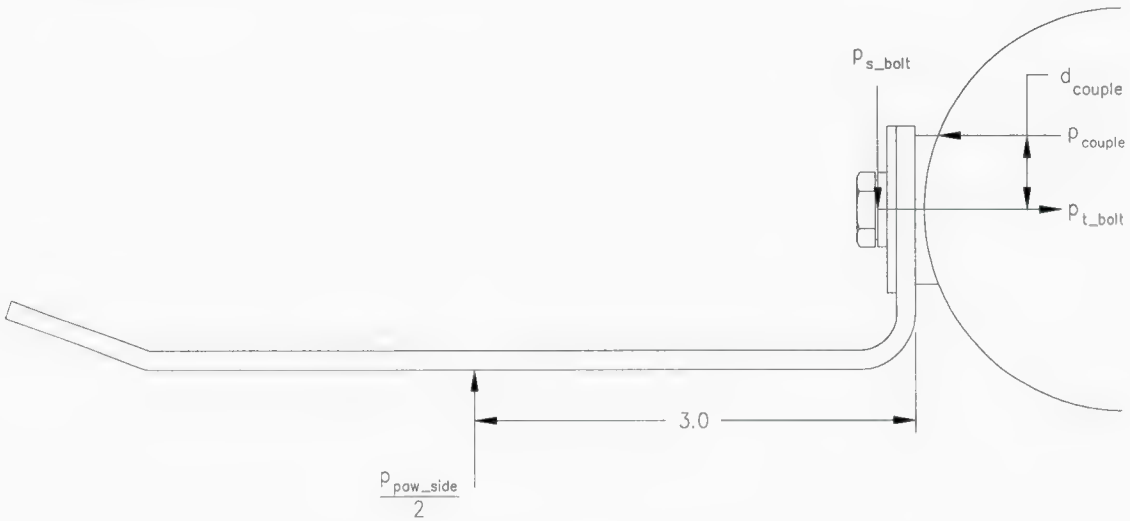


Figure 11 – Load on Bolts

The bending moment from the applied load acts as a couple with tension on the bolt, and compression on the upper side of the spacer.

$d_{couple} := 0.5 \cdot in$ Distance from centre of bolt to edge of spacer

$M_{couple} := p_{paw\_side} \cdot 3 \cdot in$

$M_{couple} = 718 \cdot in \cdot lbf$ Moment from applied load to attachment bolt

$$p_{couple} := \frac{M_{couple}}{d_{couple}}$$

$p_{couple} = 1437 \cdot lbf$ Couple load (tension on bolt, compression on top edge of spacer)

$p_{t\_bolt} := p_{couple}$

$p_{t\_bolt} = 1437 \cdot lbf$ Tension on bolt

Using Bruhn, Chapter D1, the margin of safety for the bolt in combined tension and shear can be found.

$P_{t\_allow} := 4170 \cdot lbf$ Allowable tension on bolt (using Fig D1.4 in Bruhn)

Margin of Safety $$MS := \frac{P_{t\_allow}}{p_{t\ bolt}} - 1$$

$MS = 1.9$

MARGIN OF SAFETY IS POSITIVE

7.0 ALLOWABLE GOUGE/SCRATCH DEPTH

The critical section in bending is at the corner where the paw is flanged up to the attachment bolts. Assuming the entire length is effective in bending, and that the ultimate strength of the material is used, the allowable gouge depth can be determined by reducing the section until the margin of safety reaches 0.

Total length of flange is 8".

$t := 0.08 \cdot in$ Thickness at gouged section

$$I := \frac{1}{12} \cdot 8 \cdot in \cdot (t)^3$$

$I = 0.000341 \cdot in^4$ Moment of inertia of effective width

$$C := \frac{t}{2}$$ Distance from centroid to outer edge

$F_{tu} := 42 \cdot ksi$ Ultimate tensile strength of 6061-T6 aluminum (Ref: MIL-HDBK-5J)

$M_{allow} := F_{tu} \cdot \frac{I}{C}$

$M_{allow} = 358 \cdot in \cdot lbf$ Allowable bending moment on forward bolted attachments (2 attachments)

Assuming half the load is applied to the forward attachments:

$M := \frac{p_{paw\_side}}{2} \cdot 3 \cdot in$

$M = 359 \cdot in \cdot lbf$ Applied bending moment to forward attachments

Margin of Safety $MS := \frac{M_{allow}}{M} - 1$

$MS = 0$

MARGIN OF SAFETY IS POSITIVE

$d_{gouge} := 0.125 \cdot in - t$

$d_{gouge} = 0.045 \cdot in$ Depth of gouge

The paw will not fail with a gouge depth of 0.045" in the static loading conditions.

APPENDIX A

CURRENT AD'S

Airworthiness Directives

Applicable to Canadian registered or manufactured aeronautical products

Database Last Updated: 2005-02-16

Directives Pertaining to Model: **ROBINSON, R44**

22 ADs found

Ctry:	AD Number:	AD Subject:	SB Reference:
US	2003-24-51	R44, R44II - EMERGENCY AD - INSPECTION	RHC SB-51
US	2003-04-05	R44 SERIES - TAIL ROTOR PITCH CHANGE BEARING	SB-43A REV A
US	2001-20-18	HORIZONTAL STABILIZER ASSEMBLY	REFER TO AD
US	2000-08-04	SPRAG CLUTCH	32
US	2000-07-03	WIRE HARNESS/FUEL LINE CHAFING	SB 31
US	99-23-01	CYCLIC CONTROL-PILOT GRIP CRACKING	
US	99-17-17	MAIN ROTOR YOKE ASSEMBLY	RHC R44 SB-35
US	99-13-11	AUX FUEL TANK SUMP DRAIN TUBE	
US	99-07-18	SPRAG CLUTCH ASSEMBLY	32
CF	CF-98-15	EXTERNAL RESCUE SYSTEMS	CAR 702.21
US	98-22-16	MAIN ROTOR BLADE CRACKING-SUPERSEDES 98-12-19	SB 27B, 28
US	98-05-10	FAILURE OF ALUMINUM ELBOWS	SB-25
US	98-04-12	LATERAL CYCLIC TRIM SPRING SHAFT WEAR	SB-26
US	97-16-02	SPRAG CLUTCH REPLACEMENT	SB 21, SB 23
US	97-02-15	PILOT MISMANAGEMENT OF ROTOR RPM	SUPERCEDES 96-11-09
CF	CF-96-09	AIRCRAFT FLIGHT MANUAL - SUPERSEDES FAA 95-26-05	AFM INSERTIONS
US	96-18-22	MAIN ROTOR GEARBOX INSPECTION (GEAR FINISH)	SB-15
US	96-11-09	SUPERCEDED BY 97-02-15	
US	95-26-05R1	FAA DIRECTIVE RESCINDED-CF-96-09 REMAINS IN EFFECT	AFM
US	95-11-10	PLACARD AGAINST LOW G CYCLIC PUSHOVER	SB-6
US	95-09-07	PREVENT BINDING IN THE CYCLIC CONTROL SYSTEM	SB-4
US	94-26-10	CYCLIC CONTROL SYSTEM FAILURE	SUPERCEDES 94-17-18

APPENDIX B

MEMO FROM JOHN SHAPLEY

Department of Transportation
Federal Aviation Administration

Applicable Requirements for Helicopter Landing Gear "Bear Paw" Installations

Date FEB 2 1 1985

From John J. Shapley
Manager, Helicopter Policy and Procedures

Reply to Attn of Staff, ASW-110

To ANE-170

In response to your letter dated December 19, 1984, requesting guidance for approval of auxiliary skid pads such as "bear paws," we hereby provide the following comments:

I. Structural Considerations.

Auxiliary skid pads, such as "Bear Paws," etc., are considered to be secondary structure and need not be designed to the full landing gear loads of subpart C of FAR Parts 27 or 29. However, even as secondary structure, auxiliary skid pads should be evaluated for reliability, durability, and possible hazards to the aircraft in accordance with §§ 27/29.601, 27/29.603, and 27/29.605. Also the general strength requirements of § 27/29.301 through § 27/29.307 should be met.

The following procedures are considered to be conservative and adequate to show compliance of auxiliary skid pad installations in accordance with the previous policy statement.

1. Static Strength:

   (a) Ground Loads

      (1) Use 1g (limit) static load at maximum gross weight and critical center-of-gravity (c.g.) of the helicopter with respect to pad loads.

      (2) Assume equal load distribution between pads.

      (3) For flexible, non-metallic pads, assume triangular load distribution on each pad in the Y-Z plane with the peak load at the skid centerline.

      (4) For rigid pads, assume rectangular load distribution on each pad in the Y-Z plane.

(b) ... ← AIR LOADS.

(1) Use force coefficient, Cn 0.55. 0.55

(2) Use Vne for calculating dynamic pressure, q.

(c) Substantiate by test and/or analysis.

2. Dynamic Loads

It should be verified that throughout the speed range from hover to Vne a resonant condition does not exist for the pads or the pad and skid landing gear combination. This should be accomplished by flight test using qualitative and/or quantitative measurements. Visual or auditory observations may be used to qualitatively verify that no resonance condition exists, or quantitative measurements using accelerometers may be obtained for verification.

3. Fatigue Substantiation of Skid Pads

Adequate fatigue substantiation can be provided by showing that the ground loads of Item 1 result in stresses which are below the endurance limit for the pad material and that the dynamic loads are low in accordance with Item 2 above.

4. Fatigue Substantiation of Original Landing Gear and Airframe (§ 27/29.971).

Verify by the flight tests of Item 2 above that no new airframe vibratory loads are introduced by the skid pads installation. If visual or auditory observations indicate significant new airframe vibratory loads may exist, instrumentation may be required to obtain quantitative vibratory data.

II. Flight Considerations

1. Performance

Unless the skid pads are very large in area, they should not have a significant effect on required helicopter performance (i.e., hover, takeoff, climb and landing). Thus performance measurements would not normally be required.

2. Flight Characteristics

Flight characteristics should be evaluated to verify that addition of the skid pads has not adversely affected controllability, manueverability, or stability (§§ 27/29.143 - 27/29.175).

(a) Controllability and Manueverability

A qualitative flight test evaluation should be conducted to compare the flight characteristics of the basic rotorcraft to the characteristics after the pad installation throughout the speed range from hover to Vne. If significant differences with the skid pads installed are noted by the test pilot, instrumentation should be installed to quantitatively verify that adequate control margins exist throughout the flight envelope.

(b) Stability

(1) Static

Quantitative static longitudinal stability should be obtained using a before and after comparison to verify that static stability has not been significantly affected by installation of the skid pads. The instrumentation required to conduct this test can be very simple since absolute control position is not required but only relative position with and without the pads. (A tape measurement of the distance between the cyclic control and a point on the instrument panel for example may be sufficient.) However, if significant differences are shown to exist, accurate instrumentation should be used to verify compliance with §§ 27/29.173 and 27/29.175.

(2) Dynamic

For helicopters certified for instrument flight, an assessment of the effect of skid pads on the dynamic stability should be made. For rotorcraft with required stability augmentation systems for IFR flight, the addition of skid pads should have little or no effect on the aircraft stability. The qualitative evaluation of Item 2(a) above will usually suffice to verify that dynamic stability characteristics have not been affected.

For rotorcraft which are IFR certified without stability augmentation systems results of the qualitative evaluation of step 2(a) and the quantitative evaluation of step 2(b)(1) above should be evaluated to determine if quantitative dynamic stability measurements are necessary. Generally if the test pilot finds no significant controllability differences and the static stability has not been affected, dynamic stability will not be affected. If a significant change in static stability is measured, dynamic stability should be closely evaluated if IFR certification of the skid pad configuration is desired.

AERO Design Ltd.

FLIGHT TEST PLAN

FTP 640.02

Installation of Bear Paws

Robinson R-44

Revision 1
04 April 2005

AERO Design Ltd.
Engineering Consultants

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TABLE OF CONTENTS

1.0 INTRODUCTION

Bear Paws are installed on the Robinson R44 series to improve stability when landing on soft terrain, such as snow.

2.0 REFERENCE

Rotorcraft Flight Manual, Robinson R44-II

Aero Design Ltd. Installation Drawing 64001, Bear Paws.

3.0 BASIS OF CERTIFICATION

R44 and R44-II

Type Certificate H11NM granted December 10, 1992.

FAR 27, including Amendment 27-24.

This flight test programme will demonstrate that the installation of Bear Paws complies with the flight requirements of the original basis of certification.

4.0 FLIGHT TEST PREPARATION

4.1 General

The flight crew should review and be familiar with the regulatory requirements of FAR 27 Subpart B - Flight prior to conducting flight tests. These requirements are included as Appendix A.

The flight crew should examine and be familiar with the modification installed including a review of the proposed Flight Manual Supplement.

The relative cyclic stick position in the various flight conditions is to be determined by attaching light retracting type tape measures between the cyclic stick and the airframe in both the longitudinal and lateral directions.

Test points must be flown accurately allowing the aircraft to stabilize before data is recorded.

Each limiting condition should be approached with caution, using an incremental build-up approach.

The flight crew should always be attentive to unusual noises, vibrations, control characteristics, attitudes and instrument indications.

4.2 Configuration

Baseline flight

The helicopter shall be in the same configuration as flown for the modification flight test except that the external portions of the modification shall be removed. The helicopter shall be ballasted to obtain the same gross weight and centre of gravity as flown for the modification flight test.

Modification flight test

Those components of the modification which alter the external profile of the aircraft shall be installed in accordance with the applicable installation drawings.

Any other unusual or particularly large external modifications should be removed if practical and all external modifications installed during flight testing should be noted in the flight test report.

The aircraft is to be ballasted to its maximum gross weight.

4.3 Flight Authority

The Certificate of Airworthiness may not be valid after the modification has been installed. Flight Authority in the form of a flight permit may be required.

Flight authority to exceed the published V_{ne} of the helicopter is required. When the V_{ne} for the modification as provided in the proposed Flight Manual Supplement does not restrict the maximum speed to less that 90% of the basic helicopter V_{ne} then, the flight permit should specifically state that a higher V_{ne} is authorized.

4.4 Definitions

Stability: It shall be possible to fly the helicopter in normal maneuvers for a continuous period of time appropriate to the operational use of the particular type of helicopter without the pilot experiencing undue fatigue or strain.

Static longitudinal stability: The characteristics of the longitudinal cyclic control shall be such that, with constant throttle and collective pitch settings, a rearward displacement of the longitudinal control shall be necessary to obtain and maintain speeds below the specified trim speed, and a forward displacement shall be necessary to obtain and maintain speeds above the specified trim speed.

Adequate control margins: There is adequate control and stick movement available from the position at the trim speed to the control stops or other obstructions to stick movement to safely control the helicopter.

5.0 FLIGHT TEST PROCEDURE

5.1 Flight Characteristics

Controllability Stability Flutter and Vibration

FAR 27.141, 27.143, 27.171 and 27.629

Low Speed

FAR 27.141(b), 27.143(a), 27.143(c), 27.171, 27.175(d) and 27.629

Hover in a fixed position at a skid height of approximately 5 – 15 ft above the ground

Translate in both sideward directions and in a rearward direction into the prevailing wind until airspeed estimated to be 17 knots (20 mph) has been reached.

Record:
- adequate control margins
- Relative lateral and longitudinal stick position (tape measurement)
- Observe and record any indications of flutter or vibrations

Climb

FAR 27.141(b), 27.143(a), 27.171, 27.175(a) and 27.629

At the recommended climb speed, V_y, from the Basic Flight Manual increase power slowly until reaching Maximum Continuous Power

Make a 30° bank turn to the left and to the right

Record:
- adequate control margins
- Relative lateral and longitudinal stick position
- Positive static longitudinal stability
- Observe and record any indications of flutter or vibrations

Level Flight

FAR 27.141(b), 27.143(a), 27.171, 27.175(b), 27.177, and 27.629

Transition from hover to forward flight increasing the speed incrementally in 10 mph steps until Maximum Continuous Power is being applied, or V_{ne} from the proposed Flight Manual Supplement is reached, whichever is less.

At each speed increment make a 30° bank turn to the left and the right

Record:
- adequate control margins
- Relative lateral and longitudinal stick position
- Positive static longitudinal stability
- Observe and record any indications of flutter or vibrations

In the basic Flight Manual, V_{ne} is 130 KIAS up to 2200 pounds, and 120 KIAS above.

At Maximum Continuous Power, V_h, or V_{ne} from the proposed Flight Manual Supplement, whichever is less

FAR 27.143(a)

Record:
- stable airspeed, V_h
- record if V_{ne} was reached prior to applying MCP

Continue to accelerate the aircraft in 10 mph increments by maintaining Maximum Continuous Power and descending as necessary V_{ne} is reached.

FAR 27.143(b) and 27.629

At each speed increment make a 30° bank turn to the left and to the right

At V_{ne} ensure there are adequate control margins and adequate pitch control

Record:
- adequate control margins
- Relative lateral and longitudinal stick position
- Positive static longitudinal stability
- Observe and record any indications of flutter or vibrations

For the flight test with modification installed only

Compare the longitudinal stick position (as measured with the measuring tape attached to the cyclic stick) for modification installed flight test to the position obtained in the baseline flight at V_{ne} this point. If the longitudinal stick position is further forward at V_{ne} with the modification installed (basic helicopter V_{ne} or proposed Flight Manual Supplement V_{ne}, whichever is less) than was determined during the baseline flight at V_{ne} then it may be necessary to further limit the V_{ne} with the modification installed due to mast bending considerations.

Applying power as required, and further descending the helicopter if necessary, cautiously accelerate the helicopter until the longitudinal cyclic stick position is in the same location as was determined in the baseline flight at V_{ne} from the basic helicopter Flight Manual.

Record:
- speed at which, for the modification installed, longitudinal cyclic stick position is in the same location as was determined in the baseline flight at the V_{ne}.

Autorotation

FAR 27.141(b), 27.143(a)(v), 27.143(d), 27.175(c) and 27.629

At each of V_y, normal cruise speed and V_h, from level flight (if possible) simulate a sudden engine failure by rapidly retarding the throttle to the idle position. The collective stick must be kept in the power-on position for at least one (1) second after the throttle is retarded before any response is made.

Record:
- assess that autorotation entry characteristics not changed from basic aircraft
- observe and report any unusually rapid rotor speed decay.
- For entry speed at V_h, adequate pitch and roll control

During descent, vary forward speed between 50% $V_{min\ rate\ of\ descent}$ and $V_{ne\ autorotation}$, (100 KIAS) making gentle turns to the left and to the right.

Record:
- adequate control margins
- unusual pitch, roll or yaw rates
- observe and record any indications of flutter or vibrations

5.2 Performance

FAR 27.65(b)

If the external modification is of significant size and shape as to affect the climb performance of the helicopter the following procedure shall be included in the flight test.

On a compass heading at 90° to the local wind conditions, from level flight at the recommended climb speed, V_y, increase power to Maximum Continuous Power maintaining airspeed. When a steady rate of climb is established, note the altimeter reading and measure the time to climb through an altitude of 1000 ft.

Record:
- Starting altitude
- Time to climb through 1000 ft.

Repeat the above procedure on the reciprocal compass heading starting at the same altitude

Record:
- Starting altitude
- Time to climb through 1000 ft.

5.3 Flight at Demonstration Speed

FAR 27.629, 27.309 and 27.1505(a)

Caution: The rotorcraft should be maneuvered gently above V_{ne}

The aircraft should be accelerated slowly above V_{ne} to ensure the target airspeed is not passed.

Applying Maximum Continuous Power and descending the aircraft as required, cautiously accelerate the aircraft to 1.11 times V_{ne}

Make a 30° bank turn to the left and the right

Record:
- maximum airspeed attained
- observe and record any indications of flutter or vibrations

In the basic Flight Manual, V_{ne} is 130 KIAS below 2200 pounds, therefore V_d must not exceed 144 KIAS.

At weights above 2200 pounds, V_{ne} is 120 KIAS, hence V_d may not exceed 133 KIAS.

5.4 Take off and Landing

FAR 27.51(a)(1), 27.75(a)(1) and 27.231

With the modification installed, perform a landing on soft ground. Observe for tendency of the installation to stick or catch in the soft ground, or any other condition that may create a hazard.

Take off from soft ground. Observe for tendency of the installation to stick or catch in the soft ground, or any other condition that may create a hazard.

5.5 Other Observations

Effect of modification on normal and emergency procedures

Record: - Comment

Effect of modification on normal and emergency egress

Record: - Comment

Evaluation of modification Flight Manual Supplement

Record: - Comment

APPENDIX A

FLIGHT TEST REPORT

Aircraft: C-FEHD
Robinson R44 II, Serial no. 10692

07 April 2005
Location: Campbell River BC

Configuration: 2,212 lbs. at take-off (max. gross weight for V_{ne} at 130 kts.)
CG at 96.3 (limited by fuel and occupant location – no additional ballast)
Bear Paws not installed.
Aircraft is a new aircraft with only ferry time from the factory.
No other modifications installed on the aircraft.

Crew: Pilot: Ed Wilcock, E & B Helicopters
DAR: Ted Burgoin, Aero Design Ltd.

Base Line Flight without BearPaws installed

Low Speed Controllability	Cyclic Stick Tape Position Lateral	Long.
- stationery hover	23.25	16.0
- sideward flight to 20 mph to right	23.75	16.25
- sideward flight to 20 mph to left	23.0	16.25
- backward flight to 20 mph	23.0	17.25

Observations:

a) adequate control margins were maintained.

Forward Flight			
- cruise	65 kts		
	straight ahead	23.5	14.25
	left turn – 30 degrees bank	23.75	14.5
	right turn – 30 degrees bank	23.5	14.0
- cruise	80 kts		
	Straight ahead	23.5	14.25
	left turn – 30 degrees bank	23.5	14.5
	right turn – 30 degrees bank	23.5	14.75
- cruise	110 kts		
	Straight ahead	23.75	13.5
	left turn – 30 degrees bank	24.0	13.5
	right turn – 30 degrees bank	23.5	13.5

-cruise	Max continuous power		
	Alt: 1,500 ft. ASL		
	V_h: 124 kts.		
	Straight ahead	23.5	13.0
	left turn – 30 degrees bank	23.5	13.25
	right turn – 30 degrees bank	23.75	13.25

-cruise	Max continuous power		
	Alt: 1,200 ft. ASL descending to achieve V_{ne}		
	V_{ne}: 130 kts.		
	Straight ahead	23.0	12.5
	left turn – 30 degrees bank	23.0	12.75
	right turn – 30 degrees bank	23.75	13.0

Observations:

a) adequate control margins were observed at each of the above listed flight speeds.
b) positive longitudinal stability was observed at each flight speed.

Climb Flight

- steady climb	60 kts		
	straight ahead	23.25	14.25
	left turn – 30 degrees bank - neutral pedal	23.0	14.5
	right turn – 30 degrees bank - neutral pedal	23.25	14.25

55 kts, MCP
Stick positions
Straight ahead
Compass heading: 220°
Start Altitude: 1,000 ft. ASL
End Altitude: 2,000 ft. ASL
Start time: 53:50
End time: 54:31
Elapsed time to climb: 0 min 41 seconds
Calculated rate of climb: 1,463 ft./min.

55 kts, MCP
Compass heading: 50°
Start Altitude: 900 ft. ASL
End Altitude: 1,900 ft. ASL
Start time: 58:51
End time: 59:33
Elapsed time to climb: 0 min 42 seconds
Calculated rate of climb: 1,429 ft./min.

Observations:

a) adequate control margins were observed at each of the above listed flight speeds.
b) positive longitudinal stability was observed at each flight speed.

Autorotation

Entry speed: 60 kts		
Entry altitude: 1,600 ft. ASL		
Stick position at entry	23.5	14.25
Stick position during descent	23.25	17.0
Entry characteristics acceptable		
Descent flight characteristics acceptable		
Entry speed: 100 kts		
Entry altitude: 1,700 ft. ASL		
Stick position at entry	23.75	13.5
Stick position during descent	23.75	17.0
Entry characteristics acceptable		
Descent flight characteristics acceptable		

Flight with Bear Paws Installed

Configuration: As in baseline flight except that installed

Low Speed Controllability	Cyclic Stick Tape Position Lateral	Long.
- stationery hover	23.25	16.0
- sideward flight to 20 mph to right- adequate pedal remaining	23.5	16
- sideward flight to 20 mph to left – adequate pedal remaining	23.25	16.25
- backward flight to 20 mph - neutral pedal	23	17.0

Observations:

a) adequate control margins were maintained during each of the low speed flights.
b) there was no visual indication of vibration of either the bear paws or the landing gear assembly.

Forward Flight

- cruise	60 kts		
	straight ahead	23.5	14.25
	left turn – 30 degrees bank - neutral pedal	23.5	14.25
	right turn – 30 degrees bank - neutral pedal	23.25	14.25
- cruise	80 kts		
	Straight ahead	23.5	14.5
	left turn – 30 degrees bank - neutral pedal	23.25	14.5
	right turn – 30 degrees bank - neutral pedal	23.5	14.75
- cruise	90 kts		
	Straight ahead	23.5	14.75
	left turn – 30 degrees bank - neutral pedal	23.75	14.25
	right turn – 30 degrees bank - neutral pedal	23.75	14.5
- cruise	104 kts		
	Straight ahead	23.5	13.0
	left turn – 30 degrees bank - neutral pedal	23.75	14.25
	right turn – 30 degrees bank - neutral pedal	24.0	14.0
- cruise	115 kts		
	Straight ahead	23.5	13.25
	left turn – 30 degrees bank - neutral pedal	24.0	14.25
	right turn – 30 degrees bank - neutral pedal	24.25	14.25

-cruise Max continuous power
Alt: 1,200 ft. ASL
V_h: 124 kts.

Straight ahead	23.5	13.5
left turn – 30 degrees bank - neutral pedal	24.0	13.25
right turn – 30 degrees bank - neutral pedal	24.25	13.5

-cruise Max continuous power
Alt: 1,200 ft. ASL descending to achieve V_{ne}
V_{ne}: 130 kts.

Straight ahead	23.0	12.5
left turn – 30 degrees bank - neutral pedal	23.5	13.0
right turn – 30 degrees bank - neutral pedal	23.5	13.0

From BASELINE flight (see previous):
Max continuous power
Alt: 1,200 ft. ASL descending to achieve V_{ne}
V_{ne}: 130 kts.

Straight ahead	23.0	12.5
left turn – 30 degrees bank	23.0	12.75
right turn – 30 degrees bank	23.75	13.0

Longitudinal stick position approximately the same at V_{ne} with the Bear Paws installed and the Bear Paws not installed. No substantial increase in drag resulting in additional mast bending considerations.

Observations:

a) adequate control margins were observed at each of the above listed flight speeds.
b) positive longitudinal stability was observed at each flight speed.
c) there was no visual indication of vibration of either the bear paws or the landing gear assembly.

Climb Flight

- steady climb 60 kts

straight ahead	23.0	14.25
left turn – 30 degrees bank - neutral pedal	23.0	14.5
right turn – 30 degrees bank - neutral pedal	23.0	14.0

55 kts, MCP
Stick positions

Straight ahead	23.0	14.25

Compass heading: 120°
Start Altitude: 800 ft. ASL
End Altitude: 1,800 ft. ASL
Start time: 24:53
End time: 25.32
Elapsed time to climb: 0 min 39 seconds
Calculated rate of climb: 1,538 ft./min.

55 kts, MCP

Compass heading: 300°
Start Altitude: 800 ft. ASL
End Altitude: 1,800 ft. ASL
Start time: 27:51
End time: 28.30
Elapsed time to climb: 0 min 39 seconds
Calculated rate of climb: 1,538 ft./min.

Observations:

a) adequate control margins were observed at each of the above listed flight speeds.
b) positive longitudinal stability was observed at each flight speed.
c) there was no visual indication of vibration of either the bear paws or the landing gear assembly.

Flight Demonstration Speed

-cruise Max continuous power
Alt: 1,400 ft. ASL descending to achieve V_d
V_d: 143 kts. achieved
straight ahead
left turn – 30 degrees bank demonstrated
right turn – 30 degrees bank demonstrated

Autorotation

Entry speed: 60 kts
Entry altitude: 1,600 ft. ASL

Stick position at entry	23.5	14.5
Stick position during descent	23.5	17.0
Entry characteristics acceptable		
Descent flight characteristics acceptable		

Entry speed: 100 kts
Entry altitude: 1,700 ft. ASL

Stick position at entry	23.5	14.25
Stick position during descent	24.	17.0
Entry characteristics acceptable		
Descent flight characteristics acceptable		

Take off and Landing

Helicopter made an "off-field" landing in a swampy area to demonstrate landing and take off characteristics under these conditions with Bear Paws installed. Skid tubes rested on long field grass approximately 6 inches underwater.

No unusual or difficult handling characteristics were observed.

General Notes:

Stick pressures remained positive throughout all flights.

No unusual flight characteristics were observed.

Stick position measurements: Stick position laterally and longitudinally measured by small, light tape measures secured to the aircraft structure and the loose end of the tape secured to the stick. The measurements are arbitrary and can only be used for comparison purposes. The measurements taken between the central stick column and the LH door post for lateral position and between the central stick column and the instrument panel for the longitudinal position. The lateral measurement is taken such that an increasing number indicates stick moved to the right. The longitudinal measurement is taken such that an increasing number indicates stick moved aft.

The V_{ne} for the R44 and R44 II is: 130 kts up to 2,200 lbs.

120 kts above 2,200 lb up to a maximum of 2,400 lb. for the R44 and 2,500 lb. for the R44 II

The helicopter was loaded to 2,200 lb. for flight testing to achieve the 130 kts. $V_{ne.}$

Pilot: _____ Witness: _____

Ed Wilcock E. Burgoin

Date: 07 April 2005 Date: 07 April, 2005

APPENDIX B

WEIGHT AND BALANCE CALCULATIONS

Weight and Balance for Flight Test

Robinson R44 II

C-FEHB, Serial No. 10692

Item	Weight (lbs.)	Arm (inches)	Moment (lb-in)
Basic Helicopter	1,528	107.24	163,863
Pilot	190	49.5	9,405
Passenger	200	49.5	9,900
Fuel			
Main	184	106	19504
Aux	110	102	11220
	2,212		213,892

C. G. = 213,892 / 2,212 = 96.7 inches

Helicopter refueled between flights to full fuel condition.

APPENDIX C

FAR 27 REQUIREMENTS

Sec. 27.65 – Climb: All engines operating.

(a) For rotorcraft other than helicopters--
(1) The steady rate of climb, at V_Y, must be determined--
(i) With maximum continuous power on each engine;
(ii) With the landing gear retracted; and
(iii) For the weights, altitudes, and temperatures for which certification is requested; and
(2) [The climb gradient, at the rate of climb determined in accordance with paragraph (a)(1) of this section, must be either--]
(i) At least 1:10 if the horizontal distance required to take off and climb over a 50-foot obstacle is determined for each weight, altitude, and temperature within the range for which certification is requested; or
(ii) [At least 1:6 under standard sea level conditions.]
(b) Each helicopter must meet the following requirements:
(1) V_Y must be determined--
(i) For standard sea level conditions;
(ii) At maximum weight; and
(iii) With maximum continuous power on each engine.
(2) [The steady rate of climb must be determined--
(i) At the climb speed selected by the applicant at or below V_{NE};
(ii) Within the range from sea level up to the maximum altitude for which certification is requested;
(iii) For the weights and temperatures that correspond to the altitude range set forth in paragraph (b)(2)(ii) of this section and for which certification is requested; and
(iv) With maximum continuous power on each engine.]

Sec. 27.141 – Flight Characteristics: General.

The rotorcraft must--
[(a) Except as specifically required in the applicable section meet the flight characteristics requirements of this subpart--
(1) At the altitudes and temperatures expected in operation;]
(2) Under any critical loading condition within the range of weights and centers of gravity for which certification is requested;
(3) For power-on operations, under any condition of speed, power, and rotor r.p.m. for which certification is requested; and
(4) For power-off operations, under any condition of speed and rotor r.p.m. for which certification is requested that is attainable with the controls rigged in accordance with the approved rigging instructions and tolerances;
(b) Be able to maintain any required flight condition and make a smooth transition from any flight condition to any other flight condition without exceptional piloting skill, alertness, or strength, and without danger of exceeding the limit load factor under any operating condition probable for the type, including--
(1) Sudden failure of one engine, for multiengine rotorcraft meeting Transport Category A engine isolation requirements of Part 29 of this chapter; and
(2) Sudden, complete power failure, for other rotorcraft; and
(3) Sudden, complete control system failures specified in Sec. 27.695 of this Part; and
(c) Have any additional characteristic required for night or instrument operation, if certification for those kinds of operation is requested. Requirements for helicopter instrument flight are contained in Appendix B of this Part.

Sec. 27.143 – Controllability and maneuverability.

(a) The rotorcraft must be safely controllable and maneuverable--
(1) During steady flight; and
(2) During any maneuver appropriate to the type, including--
(i) Takeoff;
(ii) Climb;
(iii) Level flight;
(iv) Turning flight;
(v) Glide;
(vi) Landing (power on and power off); and
(vii) Recovery to power-on flight from a balked autorotative approach.
(b) The margin of cyclic control must allow satisfactory roll and pitch control at V_{NE} with--
(1) Critical weight;
(2) Critical center of gravity;
(3) Critical rotor r.p.m.; and
(4) Power off (except for helicopters demonstrating compliance with paragraph (e) of this section) and power on.
(c) A wind velocity of not less than 17 knots must be established in which the rotorcraft can be operated without loss of control on or near the ground in any maneuver appropriate to the type (such as crosswind takeoffs, sideward flight, and rearward flight), with--
(1) Critical weight;
[(2) Critical center of gravity;
(3) Critical rotor r.p.m.; and
(4) Altitude, from standard sea level conditions to the maximum altitude capability of the rotorcraft or 7,000 feet, whichever is less.**]**
(d) The rotorcraft, after (1) failure of one engine in the case of multiengine rotorcraft that meet Transport Category A engine isolation requirements, or (2) complete engine failure in the case of other rotorcraft, must be controllable over the range of speeds and altitudes for which certification is requested when such power failure occurs with maximum continuous power and critical weight. No corrective action time delay for any condition following power failure may be less than--
(i) For the cruise condition, one second, or normal pilot reaction time (whichever is greater); and
(ii) For any other condition, normal pilot reaction time.
(e) For helicopters for which a V_{NE} (power-off) is established under Sec. 27.1505(c), compliance must be demonstrated with the following requirements with critical weight, critical center of gravity, and critical rotor r.p.m.:
(1) The helicopter must be safely slowed to V_{NE} (power-off), without exceptional pilot skill, after the last operating engine is made inoperative at power-on V_{NE}.
(2) At a speed of 1.1 V_{NE} (power-off), the margin of cyclic control must allow satisfactory roll and pitch control with power off.

Sec. 27.171 – Stability: General

The rotorcraft must be able to be flown, without undue pilot fatigue or strain, in any normal maneuver for a period of time as long as that expected in normal operation. At least three landings and takeoffs must be made during this demonstration.

Sec. 27.173 – Static longitudinal stability.

[(a) The longitudinal control must be designed so that a rearward movement of the control is necessary to obtain a speed less than the trim speed, and a forward movement of the control is necessary to obtain a speed more than the trim speed.
(b) With the throttle and collective pitch held constant during the maneuvers specified in Sec. 27.175(a) through (c), the slope of the control position versus speed curve must be positive throughout the full range of altitude for which certification is requested.
(c) During the maneuver specified in Sec. 27.175(d), the longitudinal control position versus speed curve may have a negative slope within the specified speed range if the negative motion is not greater than 10 percent of total control travel.]

Sec. 27.175 – Demonstration of static longitudinal stability.

(a) *Climb.* Static longitudinal stability must be shown in the climb condition at speeds from 0.85 V_Y to 1.2 V_Y, with--
(1) Critical weight;
(2) Critical center of gravity;
(3) Maximum continuous power;
(4) The landing gear retracted; and
(5) The rotorcraft trimmed at V_Y.
(b) *Cruise.* Static longitudinal stability must be shown in the cruise condition at speeds from 0.7 V_H or 0.7 V_{NE}, whichever is less, to 1.1 V_H or 1.1 V_{NE}, whichever is less, with--
(1) Critical weight;
(2) Critical center of gravity;
(3) Power for level flight at 0.9 V_H or 0.9 V_{NE}, whichever is less;
(4) The landing gear retracted; and
(5) [The rotorcraft trimmed at 0.9 V_H or 0.9 V_{NE}, whichever is less.]
(c) *Autorotation.* Static longitudinal stability must be shown in autorotation at airspeeds from 0.5 times the speed for minimum rate of descent to V_{NE} or to 1.1 V_{NE} (power-off) if V_{NE} (power-off) is established under Sec. 27.1505(c), and with--
(1) Critical weight;
(2) Critical center of gravity;
(3) Power off;
(4) The landing gear--
(i) Retracted; and
(ii) Extended; and
(5) The rotorcraft trimmed at appropriate speeds found necessary by the Administrator to demonstrate stability throughout the prescribed speed range.
(d) *Hovering.* For helicopters, the longitudinal cyclic control must operate with the sense and direction of motion prescribed in Sec. 27.173 between the maximum approved rearward speed and a forward speed of 17 knots with--
(1) Critical weight;
(2) Critical center of gravity;
(3) Power required to maintain an approximate constant height in ground effect;
(4) The landing gear extended; and
(5) The helicopter trimmed for hovering.

Sec. 27.177 – Static directional stability.

[Static directional stability must be positive with throttle and collective controls held constant at the trim conditions specified in Sec. 27.175 (a) and (b). This must be shown by steadily increasing directional control deflection for sideslip angles up to $\pm 10°$ from trim. Sufficient cues must accompany sideslip to alert the pilot when approaching sideslip limits.]

Transport Canada / Transports Canada

FLIGHT AUTHORITY / AUTORITÉ DE VOL

To - À:
E & B Helicopters Ltd., PO Box 1000, Campbell River, BC V9W 6Y4

Nationality and Registration Marks Marques de nationalité et d'immatriculation	Aircraft Manufacturer and Model Constructeur et modèle de l'aéronef	Aircraft Serial Number Numéro de série de l'aéronef
C-FEHD	Robinson Helicopter Company, R44 II	10692

☐ **CERTIFICATE OF AIRWORTHINESS** **CERTIFICAT DE NAVIGABILITÉ**

In respect of the noise emission standards this aircraft:
En vertu des normes d'émission de bruit, l'aéronef mentionné:

☐ is not required to comply with requirements
n'est pas obligé de satisfaire aux exigences

☐ complies with the requirements specified below
satisfait aux exigences précisées ci-dessous

☐ **SPECIAL CERTIFICATE OF AIRWORTHINESS** **CERTIFICAT SPÉCIAL DE NAVIGABILITÉ**

☐ Provisional - Provisoire ☐ Amateur-Built - Construction amateur ☐ Owner Maintenance - Maintenance par le propriétaire

☐ Restricted - Restreint ☐ Limited - Limité

This document is subject to the following operating conditions of issue:
Le présent document est assujetti aux conditions d'exploitation suivantes :
▶ Indicate Numbers: Inscrire les numéros :

The aircraft may only be operated from:
L'aéronef ne peut être exploité qu'à partir de :

Gross take-off weight not to exceed:
Ne pas excéder la masse maximale brute au décollage :
_____ lb _____ kg
☐ As per Flight Manual - Selon le manuel de vol

☑ **Flight Permit - Specific Purpose**
Permis de vol - Fin Spécifique

☐ **Flight Permit - Experimental**
Permis de vol - Expérimental

☐ Ferry Flight
Vol de convoyage

☐ Demonstration, market survey or crew training
Vol de démonstration, étude de marché ou formation d'équipage

☐ Importation or exportation flight
Vol pour fin d'importation ou d'exportation

☑ Other temporary purposes (Specify)
Pour d'autres fins temporaires (Préciser) Aero Design Ltd. flight test program of Bear Paws

Flight from - Vol de	To - À	To - À
E & B Helicopters, Campbell River, BC	E & B Helicopters, Campbell River, BC	

This document is subject to the following operating conditions of issue:
Le présent document est assujetti aux conditions d'exploitation suivantes :
▶ Indicate Numbers: Inscrire les numéros : 4, 6, 8, 9, 11

The aircraft may only be operated from:
L'aéronef ne peut être exploité qu'à partir de :
Installation, configuration and flight to be in accordance with AERO Design drwg 64001 & instructions. VNE limited to 143 KIAS.

Gross take-off weight not to exceed:
Ne pas excéder la masse maximale brute au décollage :
_____ lb _____ kg
☑ As per Flight Manual - Selon le manuel de vol

DEPARTMENT OF TRANSPORT - MINISTÈRE DES TRANSPORTS
Civil Aviation Safety Inspector
0463
Canada
Inspecteur de la securite de l'Aviation civile

This document is valid for the number of days indicated on the right, following the date of issue. Where pertinent, a replacement flight authority will be issued to you.
Le présent document reste valide pendant le nombre de jours indiqués à droite qui suivent la date de délivrance. S'il y a lieu, une autorite de vol de remplacement vous sera délivré.
▶ Days - Jours: 90

For the Minister of Transport - Pour le ministre des Transports	Date of Issue (Y/M/D) - Date de délivrance (A/M/J)	Region - Région
R. Mann	2005/04/07	Pacific

Fee paid - Montant versé $ 45. Invoiced ☐ Cash Comptant ☐ Cheque Chèque Receipt No. N° du reçu _____

Canada

24-0075 (0007-01)

COPY 1 - COPIE 1

Operating Conditions

1. Valid for the purpose of (specify purpose);
2. Use as a commercial aircraft prohibited;
3. Crew members only, no passengers;
4. Crew members only - no passengers, except those persons whom the pilot-in-command determines as having a bona fide interest in the demonstration;
5. Crew members shall be the holders of valid and subsisting pilot licences issued or endorsed by Canada or the (state of registry to be specified) and which are appropriate to their duties;
6. Gross take-off weight not to exceed (specific weight to be listed on the flight permit);
7. Flight into known or predicted icing conditions prohibited;
8. VNE to be established by flight test;
9. Day VFR only;
10. VFR only;
11. Flight over built-up areas prohibited;
12. Flight over built-up areas prohibited, and flight in congested airspace to be avoided;
13. Flight over built-up areas prohibited except during take-offs and landings;
14. Flight authority issued by (specify authority) shall be valid and shall be carried on board the aircraft together with this validation;
15. Controlling Air Traffic Control unit to be informed of the experimental nature of the aircraft and the evaluation program prior to flight;
16. The aircraft shall be formally or provisionally registered in (specify state);
17. Compliance required with the conditions on the (specify type of permit and authority);
18. Controlling Agency at airport of take-off shall be informed of overload conditions prior to take-off;
19. Permission of the foreign aviation authority required prior to flight in their airspace;
20. The aircraft can only operate from a base indicated by Transport Canada in order to provide the highest degree of safety for the operation of the aircraft;
21. The aircraft shall not be operated (flown) more than 25 nautical miles from the base mentioned in (20) except with written authority of the Regional Director Aviation Licensing, (specify region) Region, which will be provided, taking into account the safety of the flight;
22. The aircraft shall not be flown over any built-up area, or open air assembly of persons;
23. Carriage of persons other than for dual instruction is prohibited (not to be used for single seat aircraft);
24. Aerobatic flight is prohibited (not to be used for balloons);
25. During the first 5 hours of flight, the aircraft can only be flown by pilots who have acquired not less than 100 hours of pilot-in-command flight time in powered aircraft (not to be used for gliders, gyroplanes, or balloons);
26. Aircraft is to be registered for "Private Purposes" only;
27. Aircraft to be placarded in the cockpit "Restricted - Agricultural Purposes Only";
28. Validity period;
29. Flight testing to be conducted away from built-up areas, airways and air routes;
30. Ferry-flight (specify from) to (specify to) to be via (specify routing) with technical landings as required;
31. The side of the aircraft fuselage is to be placarded, in a place that is readily visible to persons entering the aircraft, in letters at least 3/8 inch in height and of a colour that contrasts sharply with the background on which they are shown, in both official languages, as follows:

NOTICE: THIS AIRCRAFT IS OPERATING WITHOUT A CERTIFICATE OF AIRWORTHINESS.

AVIS : CET AÉRONEF VOLE SANS CERTIFICAT DE NAVIGABILITÉ.

Conditions d'exploitation

1. Valide aux fins de (préciser les fins);
2. L'exploitation à titre d'aéronef commercial est interdite;
3. Membres d'équipage seulement - pas de passagers;
4. Membres d'équipage seulement - pas de passagers, sauf les personnes qui de l'avis du commandant de bord ont un intérêt réel dans la démonstration;
5. Les membres d'équipage doivent être titulaires de licences de pilote valides et en vigueur délivrées ou annotées par le Canada ou (préciser l'État d'immatriculation) et correspondant à leurs fonctions.
6. Ne pas excéder la masse maximale brute au décollage (qui doit être indiquée sur le permis de vol);
7. Vol interdit dans des conditions de givrage existantes ou prévues;
8. La VNE doit être établie par essai en vol;
9. VFR de jour seulement;
10. VFR seulement;
11. Le survol des zones bâties est interdit;
12. Le survol des zones bâties est interdit, et le vol dans un espace aérien à forte densité de circulation est à éviter;
13. Le survol des zones bâties est interdit, sauf au décollage et à l'atterrissage;
14. L'autorité de vol délivrée par (préciser l'autorité) doit être en vigueur et se trouver à bord de l'aéronef avec la présente validation;
15. L'unité de contrôle de la circulation aérienne qui exerce le contrôle doit être informée avant le vol de la nature expérimentale de l'aéronef et du programme d'évaluation;
16. L'aéronef doit être officiellement ou provisoirement immatriculé dans (préciser l'État);
17. La conformité avec les conditions figurant sur le (préciser le type de permis et l'autorité) est obligatoire;
18. L'organisme qui exerce le contrôle à l'aéroport de décollage doit être informé avant le décollage des conditions de surcharge;
19. Le vol dans l'espace aérien étranger est interdit, sauf avec l'autorisation préalable de l'autorité de l'aviation civile étrangère en cause;
20. L'aéronef ne peut être exploité qu'à partir de la base précisée par Transports Canada de façon à garantir le degré optimal de sécurité d'exploitation de l'aéronef;
21. L'aéronef ne peut être exploité que dans une zone d'un rayon maximum de 25 NM de la base mentionnée à l'alinéa 20, sauf avec l'autorisation écrite du directeur régional de la navigabilité, région (préciser la région), qui sera fournie compte tenu de la sécurité du vol;
22. Il est interdit de survoler des zones bâties ou des rassemblements en plein air;
23. Il est interdit de transporter des personnes sauf pour l'instruction en double commande (ne pas utiliser dans le cas des aéronefs monoplaces);
24. Le vol d'acrobatie aérienne est interdit (ne pas utiliser dans le cas de ballons);
25. Seul un pilote ayant accumulé au moins 100 heures de vol à titre de commandant de bord d'aéronefs propulsés par un organe moteur est autorisé piloter cet aéronef au cours des cinq premières heures de vol (ne pas utiliser dans le cas des planeurs, des autogires ou des ballons);
26. L'aéronef doit être immatriculé « à des fins privées » seulement;
27. Une affichette « Restreint - fins agricoles seulement » doit être apposée dans le poste de pilotage;
28. Période de validité;
29. Les essais en vol doivent être effectués hors des zones bâties, des voies aériennes et des routes aériennes;
30. Le vol de convoyage doit être effectué de (préciser la partance) à (préciser la destination) via (préciser la route) avec escales techniques au besoin;
31. Une affichette doit être apposée au côté du fuselage de l'aéronef, en un endroit facilement visible pour les personnes qui montent dans l'aéronef, en lettres d'au moins 3/8 pouce de hauteur et d'une couleur contrastant clairement avec le fond sur lequel elles sont apposées, dans les deux langues officielles, portant les mots :

AVIS : CET AÉRONEF VOLE SANS CERTIFICAT DE NAVIGABILITÉ.

NOTICE: THIS AIRCRAFT IS OPERATING WITHOUT A CERTIFICATE OF AIRWORTHINESS.

AERO DESIGN LTD.
2013 – 39th Ave N. E., Calgary, Alberta, T2E 6R7 aerodesign@telusplanet.net

F A X C O V E R S H E E T

DATE:	April 4, 2005	**TIME:**	9:51 AM
TO:	**Ed Wilcock**	**PHONE:**	250-287-4421
	E&B Helicopters	**FAX:**	250-287-4352
FROM:	J. Clarke Aero Design Ltd.	**PHONE:** **FAX:**	403-250-8027 403-250-8333

Number of pages including cover sheet: 2

RE: FLIGHT PERMIT APPLICATION

Ed,

Attached is the flight permit application for flight testing of the bear paws. Complete the form and submit it to your Transport Canada contact person. They may want to contact Greg Oucharek at Transport Canada Aircraft Certification here in Calgary at 403-292-4990.

Jeff Clarke.

Jeff

Transport Canada / Transports Canada
Aviation / Aviation

APPLICATION FOR A FLIGHT PERMIT

DEMANDE DE PERMIS DE VOL

INSTRUCTIONS ▶ Print or type all entries. See Airworthiness Manual Chapter 507D and Airworthiness Manual Advisory AMA 507D/1 for the use and disposition of this form.
Dactylographier ou écrire en lettres moulées. Consulter le chapitre 507D du Manuel de navigabilité et la circulaire consultative AMA 507 D/1 qui précisent la façon de remplir et d'acheminer la présente formule.

A. AIRCRAFT IDENTIFICATION — IDENTIFICATION DE L'AÉRONEF

1. Owner - Propriétaire

2. Address - Adresse

3. Aircraft Manufacturer - Constructeur de l'aéronef	4. Model - Modèle	5. Serial Number - Numéro de série	6. Nationality and Registration Marks Marques de nationalité et d'immatriculation
Robinson	R44		

B. FLIGHT PERMIT REQUESTED - *Check applicable boxes* — PERMIS DE VOL DEMANDÉ - *Cocher la ou les case(s) voulue(s)*

1. ☐ Experimental Flight Permit
Permis de vol expérimental

2. ☐ Specific Purpose Flight Permit
Permis de vol à une fin spécifique

(a) ☐ Ferry Flight
Vol de convoyage

(b) ☐ Importation or Exportation Flight
Vol à l'importation ou à l'exportation

(c) ☐ Demonstration, Market Survey or Crew Training
Vol de démonstration, étude de marché ou formation d'équipage

(d) ☒ Flight Test following repair, modification or maintenance
Essais en vol après réparation, modification ou maintenance

(e) ☐ Other purpose (Specify)
Autre fin (Préciser)

C. FLIGHT DESCRIPTION AND AIRCRAFT LIMITATIONS — DESCRIPTION DU VOL ET LIMITATIONS DE L'AÉRONEF
Description of Flight(s) *Use attachment when appropriate* — Description du ou des vol(s) Joindre une feuille au besoin

1. From - Aérodrome de départ	2. To - Aérodrome de destination	
Campbell River (YBL)	Campbell River (YBL)	
3. Via - Escales	4. Date	5. Duration - Durée
	04 April 2005	90 days

6. Aircraft does not meet the applicable airworthiness requirements as follows: - Raisons pour lesquelles l'aéronef ne satisfait pas aux exigences de navigabilité en vigueur:

Bear Paws installed in accordance with AERO Design Ltd. drawing 64001.

7. The following restrictions are considered necessary for safe operations: - Les restrictions suivantes sont nécessaires pour la conduite des vols en toute sécurité:

- Occupants limited to persons involved with flight test program
- No flight over built up areas
- Day VFR conditions
- Vne = 143 KIAS (1.1 x Vne in RFM)
- Log book entry stating that the installation was performed in accordance with the drawings listed in section 6., signed by an AME

D. CERTIFICATION

I hereby certify that the aircraft described above is in a condition for safe operation.

Je, soussigné, certifie que l'aéronef décrit ci-dessus est en bon état de vol.

Signature	Date (Y-A - M - D-J)	
		☐ Registered Owner as shown on the Certificate of Registration Propriétaire enregistré selon le certificat d'immatriculation ☐ Authorized Representative Représentant autorisé

24-0044 (93.04)

Canada

E. Burgoin

From: "E. Burgoin" <ted.aerodesign@telusplanet.net>
To: "Massicotte, Serge" <MASSICS@tc.gc.ca>
Sent: Wednesday, April 06, 2005 9:27 AM
Subject: Re: Robinson R-44 Bear Paw Installation - Flight Testing

OK we'll add 27.75(a)(1) and 27.231 to the compliance program. Will make a landing with power on on soft ground to show compliance. I'm not particularly comfortable asking the pilot to make an off-airport landing from a power off autorotation for this mod - it's opening up the exposure to have something go wrong for questionable added benefit.

Based on your reasoning for adding 27.75 to the compliance program then we should also add 27.51(a)(1) Takeoff and cover it at the same time. Got to get out of the swamp anyhow.

Is this OK with you

Ted.

> ----- Original Message -----
> **From:** Massicotte, Serge
> **To:** E. Burgoin
> **Cc:** Oucharek, Gregory
> **Sent:** Tuesday, April 05, 2005 11:55 AM
> **Subject:** RE: Robinson R-44 Bear Paw Installation - Flight Testing
>
> Hi Ted,
>
> 27.75 - I think we should do at least one landing on softer ground so that the mod is "put to test" at least once during the evaluation. You don't have to land in a swamp up to the aircraft belly but it would be nice to confirm the bear paws don't have a tendency to stick or catch in a way that could surprise the pilot. This would also address 27.231.
>
> It is true that two-bladed, unhinged rotor designs are not susceptible to ground resonance per say. I was more thinking about oscillations/bouncing tendencies that are in fact covered under 27.231. However, based on your design description below, that should not happen anyway. We can leave para 27.241 out of the CP.

E. Burgoin

From: "Massicotte, Serge" <MASSICS@tc.gc.ca>
To: "E. Burgoin" <ted.aerodesign@telusplanet.net>
Cc: "Oucharek, Gregory" <OUCHARG@tc.gc.ca>
Sent: Tuesday, April 05, 2005 11:55 AM
Subject: RE: Robinson R-44 Bear Paw Installation - Flight Testing

Hi Ted,

27.75 - I think we should do at least one landing on softer ground so that the mod is "put to test" at least once during the evaluation. You don't have to land in a swamp up to the aircraft belly but it would be nice to confirm the bear paws don't have a tendency to stick or catch in a way that could surprise the pilot. This would also address 27.231.

It is true that two-bladed, unhinged rotor designs are not susceptible to ground resonance per say. I was more thinking about oscillations/bouncing tendencies that are in fact covered under 27.231. However, based on your design description below, that should not happen anyway. We can leave para 27.241 out of the CP.

Serge Massicotte
Engineering Test Pilot
Aircrat Certification - Transport Canada
(613)941-6212

CP
1 landing on soft ground.
add to FTP.

-----Original Message-----
From: E. Burgoin [mailto:ted.aerodesign@telusplanet.net]
Sent: Monday, April 04, 2005 4:17 PM
To: Massicotte, Serge
Subject: Fw: Robinson R-44 Bear Paw Installation - Flight Testing

----- Original Message -----
From: E. Burgoin
To: Oucharek, Gregory
Sent: Monday, April 04, 2005 2:15 PM
Subject: Re: Robinson R-44 Bear Paw Installation - Flight Testing

Serge:

The installation is higher than the bottom surface of the skid tube so that on hard surfaces the bear paw does not touch the surface. It is only on soft ground that the bear paw will contact the landing surface. FAR27.75 would appear to be no change from Type Approval unless you want us to land in muskeg.

What test would you like to see here?

Will add 27.173 to CP and Flight Test program

FAR 27.231 General and FAR 27.341 Ground Resonance should not apply since the R44 is a two bladed rotor. According to R. Prouty (spelling?) at the helicopter design course in Vancouver put on by Transport Canada a few years ago, ground resonance only occurs with 3 or more bladed rotors.

The CAR 27 is what you get when you convert from CAR 6 to FAR 27. Sorry about that. We'll get that

fixed.

----- Original Message -----
From: Oucharek, Gregory
To: E. Burgoin (E-mail)
Cc: Massicotte, Serge
Sent: Monday, April 04, 2005 12:40 PM
Subject: FW: Robinson R-44 Bear Paw Installation - Flight Testing

Ted,

Please see comments from Flight Test that follow. It is requested that the flight test report be supplemented to include statements related to a qualitative assessment of the additional paragraphs mentioned. Also, tabulated flight test cards are requested which define your test points and summary notes taken during the flight test (it was assumed these were to be included in Appendix A of FTP 640.02?). Flight Test would like a quick review of these cards prior to conducting the test.

You will note that finding of compliance will remain with TC Flight Test so please complete an AE-100 recommending approval of the flight test report.

It appears from earlier correspondence that you are planning to participate as Test Witness. If this is the case please send me a request to extend your delegation to act in this capacity.

Please contact Serge or myself should you wish to discuss any points further.

Thanks,

Greg Oucharek, P. Eng
Senior Engineer, Aircraft Certification
Prairie & Northern Region,
Calgary, Alberta
(403) 292-4990

-----Original Message-----
From: Massicotte, Serge
Sent: Monday, April 04, 2005 12:00 PM
To: Oucharek, Gregory
Subject: RE: robinson R44 Bear Paw Installation

Hi Greg,

just had a chat with Bill. He concurs that our preferred option is to have the applicant's pilot conduct subject testing. This is based on Mr Wilcox extensive flight experience in general as well as on the R-44 specifically. We will need to review the flight test data and we want to retain the finding of compliance for the "Performance" and "Flight Characteristics" paragraphs, based on Ted's post flight report.

As far as the CP is concerned, I believe we need to add the following para's:
27.75 Landing;
27.173 Static Longitudinal Stability;
27.231 General; and
27.241 Ground Resonance.

Ted should review the test plan to remove references to CAR 27 (on a few occasions ...). I would also like to see the climb test conducted to compare climb performance. Give me a call to discuss if you wish.

Regards,

DRAFT 'C'
TRANSPORT CANADA
ACCEPTED.

INSTRUCTIONS FOR CONTINUED AIRWORTHINESS
ICA 640.90

BEAR PAWS INSTALLATION

Robinson R44, R44 II

Preface

These Instructions for Continued Airworthiness shall be included in the Robinson R44 or R44 II Maintenance Manual when the Bear Paws are installed in accordance with AERO Design Ltd. Document Control List DCL640, Revision 0, or later approved revision.

The information contained herein supplements the information in the basic Maintenance Manual. For Maintenance practices and procedures not contained in these Instructions for Continued Airworthiness refer to the basic Maintenance Manual and its approved supplements.

Revision 0
Date: 30 March, 2005

AERO Design Ltd.
2013 39th Avenue N.E., Calgary, Alberta T2E 6R7
Phone: (403) 250-8027
Fax: (403) 250-8333

RECORD OF REVISIONS

Revision Number	Issue Date	Date Inserted	By
0			Original Issue

LIST OF EFFECTIVE PAGES

Chapter – Section - Subject	Page	Revision No.
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SECTION 5 – LANDING GEAR

5-1 INTRODUCTION

The following Instructions for Continued Airworthiness (ICA) satisfy the requirements of 14 CFR 27.1529, and provide the information necessary to complete the on-going maintenance and inspections required for the Robinson R44 and R44 II rotorcraft when modified with the Bear Paws Installation as described herein. The installation is the same for both the R44 and R44 II rotorcraft.

5-2 REFERENCE DOCUMENTS

AERO Design Ltd. Installation drawing 64001

5-3 DEFINITIONS AND ABBREVIATIONS

BL - Butt Line (RBL is Right Butt Line, LBL is Left Butt Line)
FS - Flight Station
ICA - Instructions for Continued Airworthiness
P/N - Part Number

5-4 GENERAL DESCRIPTION

The Bear Paws Installation consists of a pair of pads made of Aluminum sheet, attached at the aft end with an aluminum strap. The paws are bolted to the aft end of the skid tube. Spacers are installed to match the radius of the skid tube.

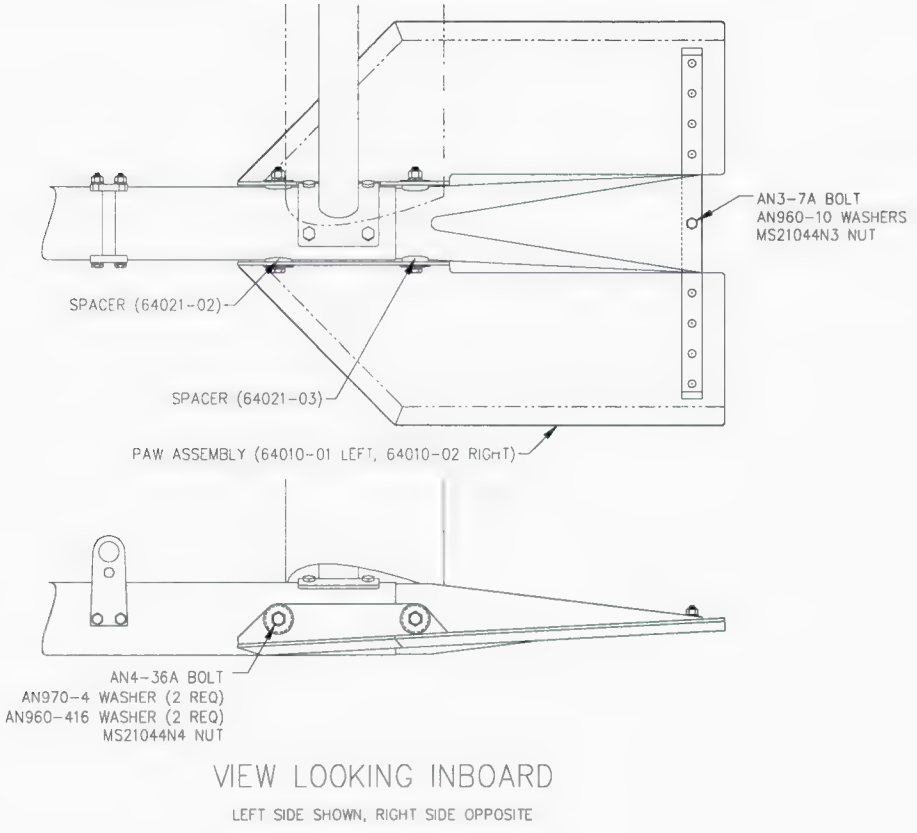

Figure 1 – Bear Paw Installation

5-5 CONTROL AND OPERATING INFORMATION

Not applicable.

5-6 SERVICING INFORMATION

The Bear Paws Installation does not affect the original rotorcraft servicing information. All components used with the Bear Paws Installation are "On Condition" items. Periodic servicing is not required.

5-7 MAINTENANCE INSTRUCTIONS

1. Inspection Schedule and Instructions

Continued airworthiness is contingent upon compliance with the following inspection items. These items shall be completed in conjunction with the Robinson R44 or R44 II Maintenance Inspection schedule, or other approved program, or upon removal and replacement of any component of the Bear Paws Installation.

Daily Inspection

1. Inspection Area: Skid Tube
    a) Inspect the bear paws for any signs of deformation, cracks or corrosion.
    b) Inspect the AN4 and AN3 bolts attaching the bear paws for condition and security.

100 hour or Annual Inspection

1. Inspection Area: Skid Tube
    a) Remove bear paws.
    b) Inspect bear paws for any signs of scratches, gouges, deformation, cracks, corrosion or other damage.
    c) Inspect fastener holes in skid tubes for elongation, wear, or other damage.
    d) Re-install bear paws.

2. Repair Instructions

a) Refer to figure 2. Scratches or gouges in section A (top or bottom) not exceeding 0.045" deep may be blended/faired out to a smooth transition.

b) Refer to figure 2. Scratches or gouges in section B (top or bottom) not exceeding 0.063" deep may be blended/faired out to a smooth transition.

c) Bear paws with scratches or gouges exceeding the above limits will be removed from service.

d) Refer to section 32-13 for protective treatment and paint information. Protective treatment is not required on bottom surface of paws.

e) Do not repair cracks in the bear paw. If cracks are found, paw is to be removed from service and a new paw installed.

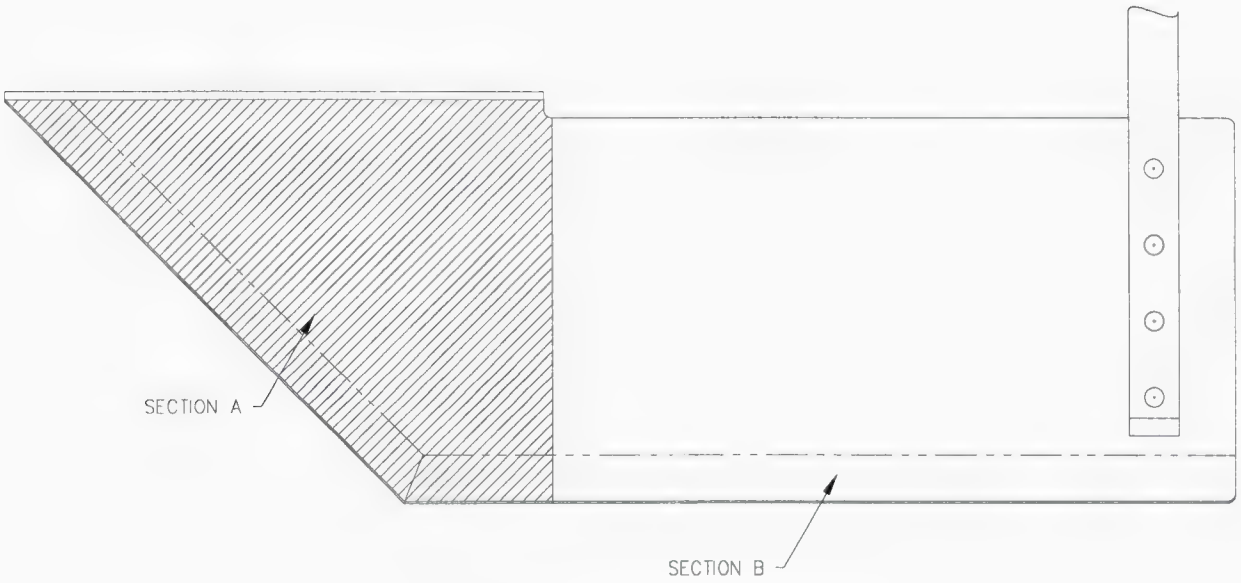

Figure 2 – Bear Paw Repair Sections

5-8 TROUBLE SHOOTING INFORMATION

Not applicable.

5-9 REMOVAL AND REPLACEMENT INFORMATION

1. Bear Paws Removal

Refer to figure 1.

1. Remove two (2) MS21044N4 nuts, four (4) AN960-416 washers, four (4) AN970-4 washers, and two (2) AN4-36A bolts securing forward end of bear paw to skid tube.
2. Remove two (2) 64021-02 forward spacers and two (2) 64021-03 aft spacers.
3. Remove one (1) MS21044N3 nut, two (2) AN960-10 washers and one (1) AN3-7A bolt securing aft end of bear paw to skid tube.
4. Remove bear paw.
5. Repeat for opposite side.

2. Bear Paws Installation

Refer to figure 1.

1. Position bear paw on aft end of skid tube. Locate forward end on existing holes.
2. Position one (1) 64021-02 spacer on either side of skid tube on forward mounting hole.
3. Install one (1) AN4-36A bolt, two (2) AN960-416 washers, two (2) AN970-4 washers, and one (1) MS21044N4 nut in forward mounting hole.

4. Position one (1) 64021-03 spacer on either side of skid tube on aft mounting hole.
5. Install one (1) AN4-36A bolt, two (2) AN960-416 washers, two (2) AN970-4 washers, and one (1) MS21044N4 nut in aft mounting hole.
6. Torque AN4 bolts to 50-70 in-lbs.
7. Insert one (1) AN3-7A bolt with one (1) AN960-10 washer through hole in strap into hole in aft end of skid tube.
8. Install one (1) AN960-10 washer and one (1) MS21044N4 nut onto AN3-7A bolt.
9. Torque AN3 bolt to 20-25 in-lbs.
10. Repeat for opposite side.

5-10 MARKINGS AND PLACARDS

Not applicable.

5-11 DIAGRAMS OF ACCESS PANELS

Not applicable.

5-12 SPECIAL INSPECTION TECHNIQUES AND INSTRUCTIONS

1. Hard Landing

Following a hard landing inspect the Bear Paws Installation in accordance with the 100 hour or annual inspection listed above in Section 32-7.

5-13 PROTECTIVE TREATMENT INFORMATION

The Bear Paws are to be alodined, primed with epoxy primer, and painted matte black with epoxy paint.

Bear Paws are to be painted matte black to prevent objectionable reflections off the bear paws into the cockpit.

5-14 STRUCTURAL FASTENER DATA

Refer to basic helicopter maintenance manual.

5-15 LIST OF SPECIAL TOOLS

Not applicable.

5-16 AIRWORTHINESS LIMITATIONS

The Airworthiness Limitations section is Transport Canada approved and specifies maintenance required under Section 571 of the Canadian Aviation Regulations, unless an alternative program has been approved.

No additional limitations have been imposed due installation of the Bear Paws Installation.

5-17 DISTRIBUTION AND AMENDMENTS

Copies of this ICA and amendments shall be distributed to all known purchasers of the Bear Paws Installation.

APPENDIX A

SUPPLEMENTAL ICA COMPLIANCE CHECK SHEET

FOR NORMAL CATEGORY ROTORCRAFT

BLOCK 1

Name of the applicant for the design change approval: AERO Design Ltd.

Description of the design change: Installation of Bear Paw on Robinson R44

Certification Basis of design change and revision date: FAR 27 at amendment 27-24

Program showing how changes to supplemental ICA will be distributed (FAR A27.1(c)): Section 5-17 of Supplemental ICA

BLOCK 2

Column 1	Column 2	Column 3
A27.2 (a) (Manual(s))	ICA ref: Robinson R44 Maintenance Manual, Section 5	Supplemental ICA ref: Single Manual (ICA640.90)
A27.2(b) (Practical arrangement)	ICA ref: Robinson R44 Maintenance Manual, Section 5	Supplemental ICA ref: Arranged in ATA format
A27.3 (a) (1) (Introduction)	ICA ref: Robinson R44 Maintenance Manual, Section 5	Supplemental ICA ref: Section 5-1
A27.3 (a) (2) (Description)	ICA ref: Robinson R44 Maintenance Manual, Section 5	Supplemental ICA ref: Section 5-4
A27.3 (a) (3) (Control & Operation)	ICA ref: N/A	Supplemental ICA ref: N/A (Section 5-5)
A27.3 (a) (4) (Servicing)	ICA ref: Robinson R44 Maintenance Manual, Section 5	Supplemental ICA ref: Section 5-6
A27.3 (b) (1) (Scheduling)	ICA ref: Robinson R44 Maintenance Manual, Section 5	Supplemental ICA ref: Section 5-7
A27.3 (b) (2) (Troubleshooting)	ICA ref: N/A	Supplemental ICA ref: N/A (Section 5-8)
A27.3 (b) (3) (Removal/replacement)	ICA ref: Robinson R44 Maintenance Manual, Section 5	Supplemental ICA ref: Section 5-9
A27.3 (b) (4) (General)	ICA ref: N/A	Supplemental ICA ref: N/A
A27.3 (c) (Access)	ICA ref: N/A	Supplemental ICA ref: N/A (Section 5-11)
A27.3 (d) (Special inspections)	ICA ref: Robinson R44 Maintenance Manual, Section 5	Supplemental ICA ref: Section 5-12
A27.3 (e) (Protective treatment)	ICA ref: Robinson R44 Maintenance Manual, Section 5	Supplemental ICA ref: Section 5-13
A27.3 (f) (Fasteners, torque values, etc)	ICA ref: Robinson R44 Maintenance Manual, Section 5	Supplemental ICA ref: Section 5-14
A27.3 (g) (Special tools)	ICA ref: N/A	Supplemental ICA ref: N/A (Section 5-15)

A27.4 (a) (AWL - Separate Section[1])	ICA ref: Robinson R44 Maintenance Manual, Section 5	Supplemental ICA ref: Section 5-16
A27.4 (a) 1 (Structures)	ICA ref: N/A	Supplemental ICA ref: N/A
A27.4 (a) 2 (Fuel Tank System)	ICA ref: N/A	Supplemental ICA ref: N/A
A27.4 (b) (Principal Manual)	ICA ref: N/A	Supplemental ICA ref: N/A

[1] Airworthiness Limitations differ from other maintenance tasks, in that they are mandatory, as a direct condition of the approval of the type design. They are therefore referenced directly in the approval document itself. However, they must also be included in the Supplemental Instructions for Continued Airworthiness.

BLOCK 3

The change in type design is adequately supported by existing ICA and/or supplemental ICA, as identified above.

Signature: _____ Date: 4 Apr 05 Design Approval Number _____

DEPARTMENT OF TRANSPORT - MINISTÈRE DES TRANSPORTS
Canada
Inspecteur de la securite de l'Aviation civile

Aero Design

From: "Oucharek, Gregory" <OUCHARG@tc.gc.ca>
To: "Aero Design" <aerodesign@telusplanet.net>
Sent: April 4, 2005 7:56 AM
Subject: RE: Robinson R44 Bear Paws Installation

Jeff,

On the MSI 53 form, the signature is that of the reviewer so Malcolm would be signing not Ted. Also, in column 2 please note the OEM MM document number for reference.

As for blending, my experience is a minimum blend ratio of 20:1 ... to minimize any remaining stress concentrations. If you prefer the wording "blended/faired out to a smooth transition" that would be fine also.

Greg

> -----Original Message-----
> **From:** Aero Design [mailto:aerodesign@telusplanet.net]
> **Sent:** Friday, April 01, 2005 11:58 AM
> **To:** Oucharek, Gregory
> **Subject:** Re: Robinson R44 Bear Paws Installation
>
> Greg,
>
> I think I have addressed all of your points. I have included MSI 53 appendix A, signed by Ted.
>
> I had a quick look at the Bell 212 Maintenance Manual in the Landing Gear section to see what they have to say about dressing out scratches. The cross tube supports have an "edge chamfer" distance given, but otherwise in the Repair or Replacement section it states:
>
> *2. Damage may be blended/faired out with emory cloth and polished out with 400 grit abrasive cloth or paper (C-423) or abrasive pad (C-407) to smooth out all scratches and to eliminate abrupt thickness changes. Cleanup shall not exceed damage limits.*
>
> No taper ratio is given.
>
> Thanks,
>
> Jeff

R44 Maintenance Manual - No Document #

Section 5 - Landing Gear.

letter stating authority to use approved

ICA

- checksheet ~> changes for FAR 27 references. Appendix A. ✓

- show N/A in ~~sec~~ column 2 for N/A things in ~~section~~ column 3 ✓

- Page 2 - list actual end page. ✓
- Page 3 - TOC ~> not on TOC ✓

Daily Inspection ~> same issues as before.

email to Ted from Flight Test. ✓

~~Sec~~

Change all CAR 27 to FAR 27 in Flight test plan.

CP - add 27.75 landing
27.173 Static long Stab
27.231 General
27.241 Ground resonance.

Change Sign off to TC for Performance and Flight Characteristics sections

INSTRUCTIONS FOR CONTINUED AIRWORTHINESS
ICA 640.90

BEAR PAWS INSTALLATION

Robinson R44, R44 II

Preface

These Instructions for Continued Airworthiness shall be included in the Robinson R44 or R44 II Maintenance Manual when the Bear Paws are installed in accordance with AERO Design Ltd. Document Control List DCL640, Revision 0, or later approved revision.

The information contained herein supplements the information in the basic Maintenance Manual. For Maintenance practices and procedures not contained in these Instructions for Continued Airworthiness refer to the basic Maintenance Manual and its approved supplements.

Revision 0
Date: 30 March, 2005

AERO Design Ltd.

2013 39th Avenue N.E., Calgary, Alberta T2E 6R7
Phone: (403) 250-8027
Fax: (403) 250-8333

RECORD OF REVISIONS

Revision Number	Issue Date	Date Inserted	By
0			Original Issue

LIST OF EFFECTIVE PAGES

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32-EFFECTIVITY	2	0
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32-10-00	4-end	0

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CHAPTER 32 – LANDING GEAR

32-1 INTRODUCTION

The following Instructions for Continued Airworthiness (ICA) satisfy the requirements of 14 CFR 27.1529, and provide the information necessary to complete the on-going maintenance and inspections required for the Robinson R44 and R44 II rotorcraft when modified with the Bear Paws Installation as described herein. The installation is the same for both the R44 and R44 II rotorcraft.

32-2 REFERENCE DOCUMENTS

AERO Design Ltd. Installation drawing 64001

32-3 DEFINITIONS AND ABBREVIATIONS

BL - Butt Line (RBL is Right Butt Line, LBL is Left Butt Line)
FS - Flight Station
ICA - Instructions for Continued Airworthiness
P/N - Part Number

32-4 GENERAL DESCRIPTION

The Bear Paws Installation consists of a pair of pads made of Aluminum sheet, attached at the aft end with an aluminum strap. The paws are bolted to the aft end of the skid tube. Spacers are installed to match the radius of the skid tube.

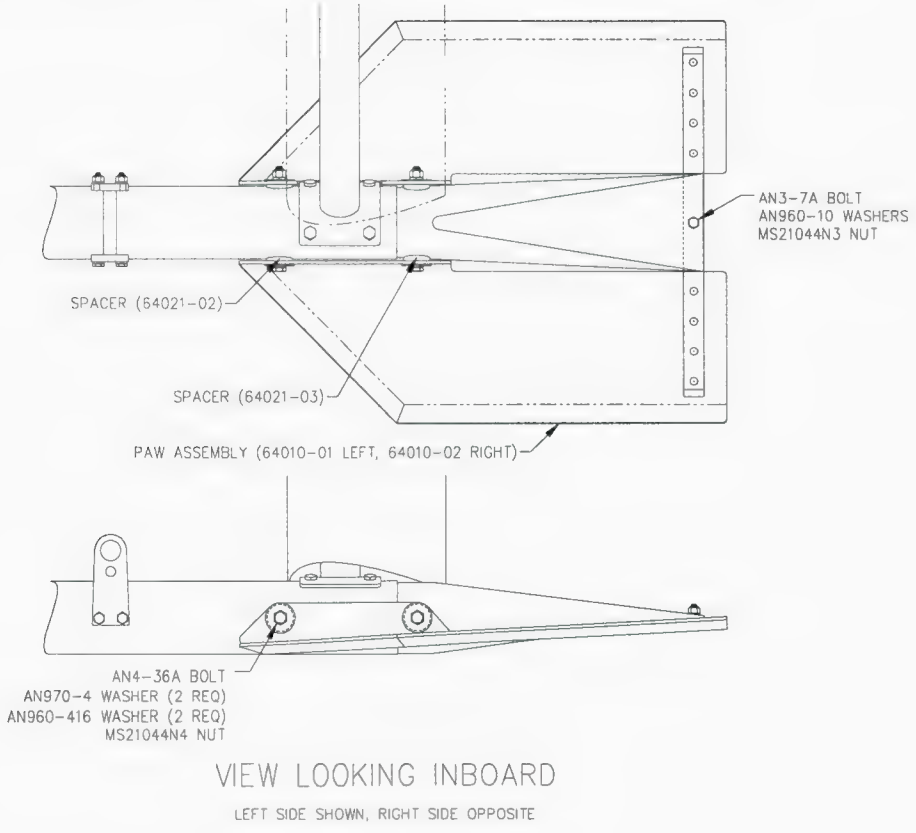

Figure 1 – Bear Paw Installation

32-5 CONTROL AND OPERATING INFORMATION

Not applicable.

32-6 SERVICING INFORMATION

The Bear Paws Installation does not affect the original rotorcraft servicing information. All components used with the Bear Paws Installation are "On Condition" items. Periodic servicing is not required.

32-7 MAINTENANCE INSTRUCTIONS

1. Inspection Schedule and Instructions

Continued airworthiness is contingent upon compliance with the following inspection items. These items shall be completed in conjunction with the Robinson R44 or R44 II Maintenance Inspection schedule, or other approved program, or upon removal and replacement of any component of the Bear Paws Installation.

Daily Inspection

1. Inspection Area: Skid Tube

    a) Inspect the bear paws for any signs of deformation, cracks or corrosion.
    b) Inspect the AN4 and AN3 bolts attaching the bear paws for condition and security.

100 hour or Annual Inspection

1. Inspection Area: Skid Tube

    a) Remove bear paws.
    b) Inspect bear paws for any signs of scratches, gouges, deformation, cracks, corrosion or other damage.
    c) Inspect fastener holes in skid tubes for elongation, wear, or other damage.
    d) Re-install bear paws.

2. Repair Instructions

a) Refer to figure 2. Scratches or gouges in section A (top or bottom) not exceeding 0.045" deep may be dressed out to a smooth contour.

b) Refer to figure 2. Scratches or gouges in section B (top or bottom) not exceeding 0.063" deep may be dressed out to a smooth contour.

c) Bear paws with scratches or gouges exceeding the above limits will be removed from service.

d) Dress out scratches and gouges to a maximum width of 5 x depth of gouge or scratch on both sides.

e) Refer to section 32-13 for protective treatment and paint information. Protective treatment is not required on bottom surface of paws.

f) Do not repair cracks in the bear paw. If cracks are found, paw is to be removed from service and a new paw installed.

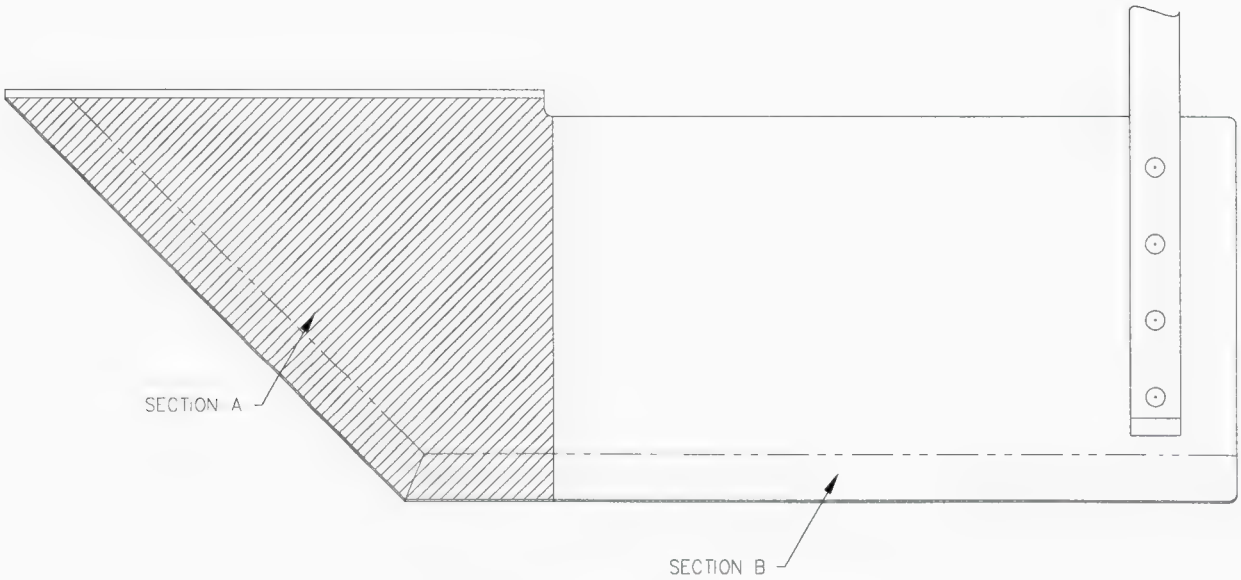

Figure 2 – Bear Paw Repair Sections

32-8 TROUBLE SHOOTING INFORMATION

Not applicable.

32-9 REMOVAL AND REPLACEMENT INFORMATION

1. Bear Paws Removal

Refer to figure 1.

1. Remove two (2) MS21044N4 nuts, four (4) AN960-416 washers, four (4) AN970-4 washers, and two (2) AN4-36A bolts securing forward end of bear paw to skid tube.
2. Remove two (2) 64021-02 forward spacers and two (2) 64021-03 aft spacers.
3. Remove one (1) MS21044N3 nut, two (2) AN960-10 washers and one (1) AN3-7A bolt securing aft end of bear paw to skid tube.
4. Remove bear paw.
5. Repeat for opposite side.

2. Bear Paws Installation

Refer to figure 1.

1. Position bear paw on aft end of skid tube. Locate forward end on existing holes.
2. Position one (1) 64021-02 spacer on either side of skid tube on forward mounting hole.
3. Install one (1) AN4-36A bolt, two (2) AN960-416 washers, two (2) AN970-4 washers, and one (1) MS21044N4 nut in forward mounting hole.

4. Position one (1) 64021-03 spacer on either side of skid tube on aft mounting hole.
5. Install one (1) AN4-36A bolt, two (2) AN960-416 washers, two (2) AN970-4 washers, and one (1) MS21044N4 nut in aft mounting hole.
6. Torque AN4 bolts to 50-70 in-lbs.
7. Insert one (1) AN3-7A bolt with one (1) AN960-10 washer through hole in strap into hole in aft end of skid tube.
8. Install one (1) AN960-10 washer and one (1) MS21044N4 nut onto AN3-7A bolt.
9. Torque AN3 bolt to 20-25 in-lbs.
10. Repeat for opposite side.

32-10 MARKINGS AND PLACARDS

Not applicable.

32-11 DIAGRAMS OF ACCESS PANELS

Not applicable.

32-12 SPECIAL INSPECTION TECHNIQUES AND INSTRUCTIONS

1. Hard Landing

Following a hard landing inspect the Bear Paws Installation in accordance with the 100 hour or annual inspection listed above in Section 32-7.

32-13 PROTECTIVE TREATMENT INFORMATION

The Bear Paws are to be alodined, primed with epoxy primer, and painted matte black with epoxy paint.

Bear Paws are to be painted matte black to prevent objectionable reflections off the bear paws into the cockpit.

32-14 STRUCTURAL FASTENER DATA

Refer to basic helicopter maintenance manual.

32-15 LIST OF SPECIAL TOOLS

Not applicable.

32-16 AIRWORTHINESS LIMITATIONS

The Airworthiness Limitations section is Transport Canada approved and specifies maintenance required under Section 571 of the Canadian Aviation Regulations, unless an alternative program has been approved.

No additional limitations have been imposed due installation of the Bear Paws Installation.

32-17 DISTRIBUTION AND AMENDMENTS

Copies of this ICA and amendments shall be distributed to all known purchasers of the Bear Paws Installation.

Aero Design

From: "Oucharek, Gregory" <OUCHARG@tc.gc.ca>
To: "Aero Design" <aerodesign@telusplanet.net>
Sent: April 1, 2005 8:36 AM
Subject: RE: Robinson R44 Bear Paws Installation

Jeff,

Looks pretty good. My only question is related to the damage allowance and repair. There is no size limit other than .063 depth ... I would expect the engineering substantiation to show the Bear Paw still structurally compliant with a full length gouge, .063 deep along its length which could be expected from a run-on landing. My point is, depth alone does not adequately define a damage limit and your substantiation needs to support any size limit allowed. Also, the term "dress" is very subjective ... what length to depth dressing (taper) ratio is required? Lastly, the repair instruction only calls for paint touch-up but further down in 32-13 the finish is specified as alodine/prime/paint ... why the difference when repairs are normally expected to "restore" original condition?

If you would address these points and complete the MSI 53 checklist I can forward to M&M for review and acceptance.

Thanks,

Greg

-----Original Message-----
From: Aero Design [mailto:aerodesign@telusplanet.net]
Sent: Thursday, March 31, 2005 3:11 PM
To: Oucharek, Gregory
Subject: Robinson R44 Bear Paws Installation

Greg,

Attached is the proposed ICA for this project. Please review and comment.

Thanks

Jeff Clarke
Technologist

Aero Design Ltd.
2013 - 39th Avenue NE
Calgary, Alberta, Canada
T2E 6R7
(403) 250-8027

DRAFT '0'

INSTRUCTIONS FOR CONTINUED AIRWORTHINESS
ICA 640.90

BEAR PAWS INSTALLATION

Robinson R44, R44 II

Preface

These Instructions for Continued Airworthiness shall be included in the Robinson R44 or R44 II Maintenance Manual when the Bear Paws are installed in accordance with AERO Design Ltd. Document Control List DCL640, Revision 0, or later approved revision.

The information contained herein supplements the information in the basic Maintenance Manual. For Maintenance practices and procedures not contained in these Instructions for Continued Airworthiness refer to the basic Maintenance Manual and its approved supplements.

Revision 0
Date: 30 March, 2005

AERO Design Ltd.

2013 39th Avenue N.E., Calgary, Alberta T2E 6R7
Phone: (403) 250-8027
Fax: (403) 250-8333

TRANSPORT CANADA
REVIEWED MARCH 31/05

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CHAPTER 32 – LANDING GEAR

32-1 INTRODUCTION

The following Instructions for Continued Airworthiness (ICA) satisfy the requirements of 14 CFR 27.1529, and provide the information necessary to complete the on-going maintenance and inspections required for the Robinson R44 and R44 II rotorcraft when modified with the Bear Paws Installation as described herein. The installation is the same for both the R44 and R44 II rotorcraft.

32-2 REFERENCE DOCUMENTS

AERO Design Ltd. Installation drawing 64001

32-3 DEFINITIONS AND ABBREVIATIONS

BL - Butt Line (RBL is Right Butt Line, LBL is Left Butt Line)
FS - Flight Station
ICA - Instructions for Continued Airworthiness
P/N - Part Number

32-4 GENERAL DESCRIPTION

The Bear Paws Installation consists of a pair of pads made of Aluminum sheet, attached at the aft end with an aluminum strap. The paws are bolted to the aft end of the skid tube. Spacers are installed to match the radius of the skid tube.

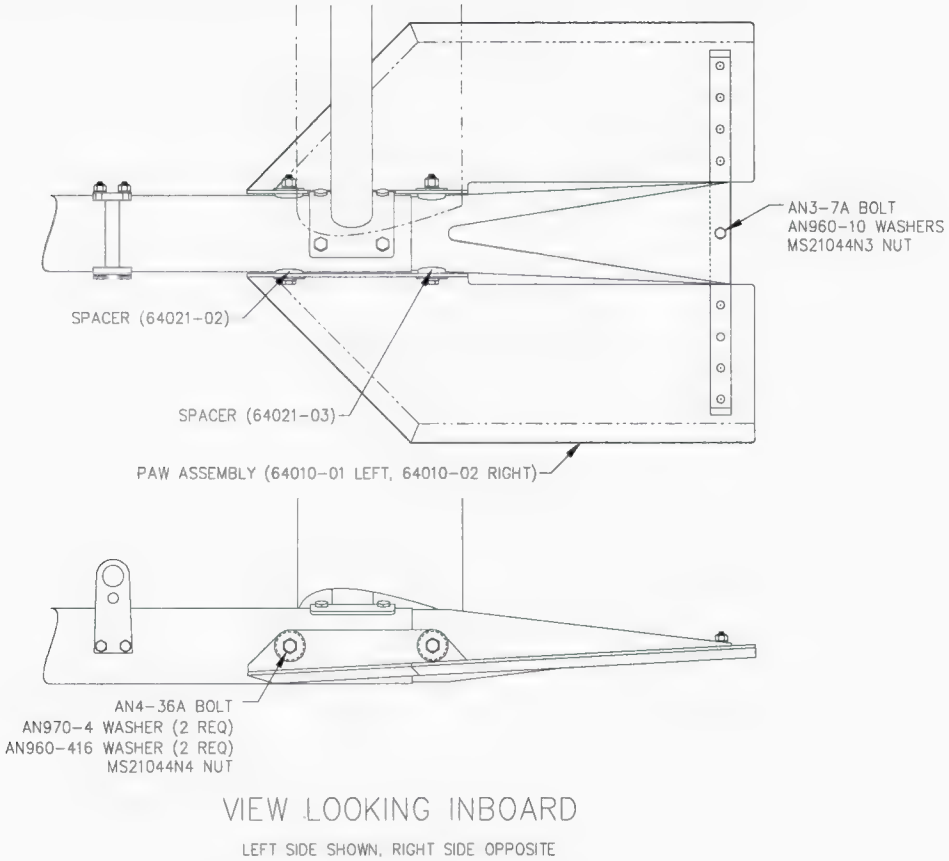


Figure 1 – Bear Paw Installation

32-5 CONTROL AND OPERATING INFORMATION

Not applicable.

32-6 SERVICING INFORMATION

The Bear Paws Installation does not affect the original rotorcraft servicing information. All components used with the Bear Paws Installation are "On Condition" items. Periodic servicing is not required.

32-7 MAINTENANCE INSTRUCTIONS

1. Inspection Schedule and Instructions

Continued airworthiness is contingent upon compliance with the following inspection items. These items shall be completed in conjunction with the Robinson R44 or R44 II Maintenance Inspection schedule, or other approved program, or upon removal and replacement of any component of the Bear Paws Installation.

Daily Inspection

1. Inspection Area: Skid Tube
    a) Inspect the bear paws for any signs of deformation, cracks or corrosion.
    b) Inspect the AN4 and AN3 bolts attaching the bear paws for condition and security.

100 hour or Annual Inspection

1. Inspection Area: Skid Tube
    a) Remove bear paws.
    b) Inspect bear paws for any signs of deformation, cracks or corrosion.
    c) Inspect fastener holes in skid tubes for elongation, wear, or other damage.
    d) Install bear paws.

2. Repair Instructions

a) Scratches or gouges on any surface not exceeding 0.063" deep may be dressed out to a smooth contour.

b) Touch up paint as required using matte black paint.

c) Do not repair cracks in the bear paw. If cracks are found, paw is to be removed from service and a new paw installed.

32-8 TROUBLE SHOOTING INFORMATION

Not applicable.

32-9 REMOVAL AND REPLACEMENT INFORMATION

1. Bear Paws Removal

Refer to figure 1.

1. Remove two (2) MS21044N4 nuts, four (4) AN960-416 washers, four (4) AN970-4 washers, and two (2) AN4-36A bolts securing forward end of bear paw to skid tube.
2. Remove two (2) 64021-02 forward spacers and two (2) 64021-03 aft spacers.
3. Remove one (1) MS21044N3 nut, two (2) AN960-10 washers and one (1) AN3-7A bolt securing aft end of bear paw to skid tube.
4. Remove bear paw.
5. Repeat for opposite side.

2. Bear Paws Installation

Refer to figure 1.

1. Position bear paw on aft end of skid tube. Locate forward end on existing holes.
2. Position one (1) 64021-02 spacer on either side of skid tube on forward mounting hole.
3. Install one (1) AN4-36A bolt, two (2) AN960-416 washers, two (2) AN970-4 washers, and one (1) MS21044N4 nut in forward mounting hole.
4. Position one (1) 64021-03 spacer on either side of skid tube on aft mounting hole.
5. Install one (1) AN4-36A bolt, two (2) AN960-416 washers, two (2) AN970-4 washers, and one (1) MS21044N4 nut in aft mounting hole.
6. Torque AN4 bolts to 50-70 in-lbs.
7. Insert one (1) AN3-7A bolt with one (1) AN960-10 washer through hole in strap into hole in aft end of skid tube.
8. Install one (1) AN960-10 washer and one (1) MS21044N4 nut onto AN3-7A bolt.
9. Torque AN3 bolt to 20-25 in-lbs.
10. Repeat for opposite side.

32-10 MARKINGS AND PLACARDS

Not applicable.

32-11 DIAGRAMS OF ACCESS PANELS

Not applicable.

32-12 SPECIAL INSPECTION TECHNIQUES AND INSTRUCTIONS

1. Hard Landing

Following a hard landing inspect the Bear Paws Installation in accordance with the 100 hour or annual inspection listed above in Section 32-7.

32-13 PROTECTIVE TREATMENT INFORMATION

The Bear Paws are to be alodined, primed with epoxy primer, and painted matte black with epoxy paint.

Bear Paws are to be painted matte black to prevent objectionable reflections off the bear paws into the cockpit.

32-14 STRUCTURAL FASTENER DATA

Refer to basic helicopter maintenance manual.

32-15 LIST OF SPECIAL TOOLS

Not applicable.

32-16 AIRWORTHINESS LIMITATIONS

The Airworthiness Limitations section is Transport Canada approved and specifies maintenance required under Section 571 of the Canadian Aviation Regulations, unless an alternative program has been approved.

No additional limitations have been imposed due installation of the Bear Paws Installation.

32-17 DISTRIBUTION AND AMENDMENTS

Copies of this ICA and amendments shall be distributed to all known purchasers of the Bear Paws Installation.

Transport Canada Transports Canada

Canada

Canadian Aviation Regulations (CARs)
Part V - Airworthiness

Airworthiness Manual Chapter 525 - Transport Category Aeroplanes
Content last revised: 2003/06/05

(2001/06/01; no previous version)

APPENDIX H

Instructions For Continued Airworthiness

H525.1 *General*

(a) This appendix specified requirements for the preparation of Instructions for Continued Airworthiness as required by 525.1529.

(b) The Instructions for Continued Airworthiness for each aeroplane must include the Instructions for Continued Airworthiness for each engine and propeller (hereinafter designated "products"), for each appliance required by any applicable airworthiness or operating rule, and any required information relating to the interface of those appliances and products with the aeroplane. If Instructions for Continued Airworthiness are not supplied by the manufacturer of an appliance or product installed in the aeroplane, the Instructions for Continued Airworthiness for the aeroplane must include the information essential to the continued airworthiness of the aeroplane.

(c) The applicant must submit to the Minister a programme to show how changes to the Instructions for Continued Airworthiness made by the applicant or by the manufacturers of products and appliances installed in the aeroplane will be distributed.

H525.2 *Format*

(a) The Instructions for Continued Airworthiness must be in the form of a manual or manuals as appropriate for the quantity of data to be provided.

(b) The format of the manual or manuals must provide for a practical arrangement.

H525.3 *Content*

The Instructions for Continued Airworthiness must contain the following manuals or sections, as

values.

(g) A list of special tools needed.

H525.4 ***Airworthiness Limitations Section***

The Instructions for Continued Airworthiness must contain a section titled Airworthiness Limitations that is segregated and clearly distinguishable from the rest of the document. This section must set forth each mandatory replacement time, structural inspection interval, and related structural inspection procedure approved under 525.571. If the Instructions for Continued Airworthiness consist of multiple documents, the section required by this paragraph must be included in the principal manual. This section must contain a legible statement in a prominent location that reads: "The Airworthiness Limitations section is approved by the Minister and specifies maintenance required by any applicable airworthiness or operating rule, unless an alternative program has been approved by the Minister."

(Change 525-2 (89-01-01))

(Change 525-3 (91-11-01))

Return to previous page

appropriate, and information:

(a) *Aeroplane maintenance manual or section.*

(1) Introduction information that includes an explanation of the aeroplane's features and data to the extent necessary for maintenance or preventive maintenance.

(2) A description of the aeroplane and its systems and installations including its engines, propellers, and appliances.

(3) Basic control and operation information describing how the aeroplane components and systems are controlled and how they operate, including any special procedures and limitations that apply.

(4) Servicing information that covers details regarding servicing points, capacities of tanks, reservoirs, types of fluids to be used, pressures applicable to the various systems, location of access panels for inspection and servicing, locations of lubrication points, lubricants to be used, equipment required for servicing, tow instructions and limitations, mooring, jacking, and levelling information.

(b) *Maintenance Instructions.*

(1) Scheduling information for each part of the aeroplane and its engines, auxiliary power units, propellers, accessories, instruments, and equipment that provides the recommended periods at which they should be cleaned, inspected, adjusted, tested, and lubricated, and the degree of inspection, the applicable wear tolerances, and work recommended at these periods. However, the applicant may refer to an accessory, instrument, or equipment manufacturer as the source of this information if the applicant shows that the item has an exceptionally high degree of complexity requiring specialised maintenance techniques, test equipment, or expertise. The recommended overhaul periods and necessary cross references to the Airworthiness Limitations section of the manual must also be included. In addition, the applicant must include an inspection program that includes the frequency and extent of the inspections necessary to provide for the continued airworthiness of the aeroplane.

(2) Troubleshooting information describing probable malfunctions, how to recognise those malfunctions, and the remedial action for those malfunctions.

(3) Information describing the order and method of removing and replacing products and parts with any necessary precautions to be taken.

(4) Other general procedural instructions including procedures for system testing during ground running, symmetry checks, weighing and determining the centre of gravity, lifting and shoring, and storage limitations.

(c) Diagrams of structural access plates and information needed to gain access for inspections when access plates are not provided.

(d) Details for the application of special inspection techniques including radiographic and ultrasonic testing where such processes are specified.

(e) Information needed to apply protective treatments to the structure after inspection.

(f) All data relative to structural fasteners such as identification, discard recommendations, and torque

MODIFICATION APPROVAL REQUEST APPLICATION FORM

MOD640, Rev. 0

1. NAME AND ADDRESS OF APPLICANT:	2. IDENTIFICATION OF PRODUCT	
	MAKE:	MODEL:
AERO Design Ltd. 2013 39th Avenue N.E. Calgary, AB, T2E 6R7	Robinson	R44
ALL CORRESPONDANCE TO: AERO Design Ltd. 2013 39th Ave N.E. Calgary, AB T2E 6R7	SERIAL No.:	REGISTRATION:

3. REQUEST FOR:

A.	SUPPLEMENTAL TYPE CERTIFICATE (STC)	☐	
B.	STC/STA REVISION	☒	STC/STA No.
C.	LIMITED SUPPLEMENTAL TYPE CERTIFICATE (LSTC)	☐	
D.	LIMITED STC/STA REVISION	☐	LSTC/LSTA No.
E.	F.A.A. SUPPLEMENTAL TYPE CERTIFICATE	☐	
F.	F.A.A. STC REVISION	☐	STC No.
G.	FAMILIARIZATION OF F.A.A. STC	☐	STC No.
H.	REPAIR DESIGN APPROVAL (RDC)	☐	
I.	PARTS DESIGN APPROVAL (PDA)	☐	

4. TITLE OF MODIFICATION OR REPAIR:
Bear Paws Installation

5. BRIEF DESCRIPTION OF MODIFICATION OR REPAIR:
Installation of bear paws on the skid tubes fabricated from aluminum sheet.

6. APPLICABLE TYPE APPROVAL (TA) OR TYPE CERTIFICATE (TC) DOCUMENTS:
A. TA NO. H-97 B. TC No. _____ C. OTHER _____

7. PROPOSED BASIS OF APPROVAL:
A. SAME AS TA ☒ B. SAME AS TC ☐ C. OTHER ☐ (Please specify) _____

8.

DOCUMENTATION CHECKLIST	REQUIRED		FOR DOT USE ONLY RECEIVED		
	YES	NO	YES	NO	DATE
COMPLIANCE PROGRAM	X				
MASTER DRAWING LIST	X				
FLIGHT MANUAL SUPPLEMENT		X			
MAINTENANCE MANUAL SUPPLEMENT		X			
INSTRUCTIONS FOR CONTINUING AIRWORTHINESS		X			
ENGINEERING REPORTS	X				
DESIGN DRAWINGS		X			
MANUFACTURE DRAWINGS & INSTALLATION INSTRUCTIONS	X				
ELECTRICAL LOAD ANALYSIS		X			
DRAFT STC, LSTC OR RDA		X			
WEIGHT AND MOMENT CHANGE	X				
FLIGHT TEST DATA					
OTHER (Specify)					

RECEIVED
MAR 3 0 2005
Transport Canada
Aircraft Certification CALGARY

9. APPLICANT'S REMARKS:

10. In addition to the payment of Aircraft Certification approval fees as prescribed in Canadian Aviation Regulations (CAR) Section 104, I agree to reimburse Transport Canada incremental expenses as in Aviation Regulation Directive No. 3, or equivalent, as applicable. For further details governing [illegible]

E & B Helicopters Ltd.

PER: _____ Consultant 04 February, 2005
SIGNATURE OF APPLICANTS TITLE DATE

11. _____ C-05-0255 SH05-17. March 31, 2005
SIGNATURE OF REGIONAL ENGINEER DATE

Form MOD, 25 March, 2001

AERO DESIGN LTD.
2013 – 39 Avenue N.E., Calgary, Alberta, T2E 6R7

Tel: 403-250-8027
Fax: 403-250-8333
aerodesign@telusplanet.net

30 March, 2005

Transport Canada
Aircraft Certification Division
800-1601 Airport Road
Calgary, Alberta
T2E 6Z8

Attn: Greg Oucharek

Your File : Not assigned
Our File : 640

Re: Robinson R44 Bear Paws Installation

Greg,

Please find attached the following documents related to this project:

Modification Approval Request Application Form	MOD640	Revision 0
Compliance Program	CP640	Revision 0
Project Summary	PS640	Revision 0
FLight Test Plan	TR640.02	Revision 0

Please extend my delegation to include the following paragraphs of FAR 27 as shown on the attached compliance program:

27.65 - Climb: All Engines Operating
27.141 - General
27.143 - Controllability and Maneuverability
27.171 - Stability: General
27.175 - Demonstration of Static Longitudinal Stability
27.177 - Static Directional Stability
27.251 - Vibration
27.629 - Flutter
27.773(a)2 - Pilot Compartment View - Reflections
27.1505 - Never Exceed Speed

I have discussed the flight test with Serge Massicotte, and he has advised that he will not require Flight Test involvement in testing this installation.

Regards,

E. Burgoin, P.Eng, DAR 290M

Encl.

APPLICANT: AERO Design Ltd.
2013 - 39th Ave N.E.
Calgary, Alberta, T2E 6R7

CORRESPONDANCE TO: AERO Design Ltd.
(If other than applicant) 2013 - 39th Ave N.E.
Calgary, Alberta, T2E 6R7

DATE: 04 February, 2005
REV. No. 0

MAKE: Robinson
MODEL: R44

REGISTRATION:
SERIAL No.:

NATURE OF WORK: Bear Paws Installation

MODEL CERTIFICATION BASIS: FAR 27, 1 February, 1965, including amendments 27-1 thru 27-24
MODIFICATION CERTIFICATION BASIS: FAR 27, 1 February, 1965, including amendments 27-1 thru 27-24

Airworthiness Requirement	Subject for Compliance or Documentary Proof	Form of Substantiation	DOT	DAR	Comments
Subpart B	**Flight**				
27.65	Climb: All Engines Operating	Flight test		X	
27.141	General	Flight test		X	
27.143	Controllability and maneuverability	Flight test		X	Flight Test in accordance with TR640.02
27.171	Stability: General	Flight test		X	
27.175	Demonstration of Static Long. Stability	Flight test		X	
27.177	Static Directional Stability	Flight test		X	
27.251	Vibration	Flight test		X	
Subpart C	**Strength Requirements**				
27.301	Loads	Analysis		X	
27.303	Factor of Safety	Analysis		X	
27.305	Strength and Deformation	Analysis		X	
27.307	Proof of Structure	Analysis		X	
27.309	Design Limitations	Flight test		X	Flight Test in accordance with TR640.02
Subpart D	**Design and Construction**				
27.601	Design	Design		X	
27.603	Materials	Specification on drawings		X	
27.607	Fasteners	Specification on drawings		X	
27.629	Flutter	Flight Test		X	Flight Test in accordance with TR640.02
27.773(a)(2)	Pilot Compartment View - Reflections	Specification on drawings		X	Part to be painted matte black
Subpart G	**Operating Limitations and Information**				
27.1505	Never-Exceed Speed	Flight Test		X	Flight Test in accordance with TR640.02

Title: **Bear Paws Installation**

Approval: STC

Customer: E & B Helicopters

Type and Model: Robinson R44, R44 II

Project Summary:

"Bear paws" are pads installed on the skid tube in order to distribute the weight of the helicopter when landing on soft surfaces, such as snow. The pads in this installation are made of aluminum sheet and are attached to using bolts through the skid tube, where the aft cross tube joins the skid tube, and to the aft end of the skid tube.

Note: Changed Product Rule does not apply to the Robinson R44. It is an excepted product in accordance with AMA500/16, Section 8.1. It is a non-turbine powered rotorcraft, with gross weight under 1360 kg.

MODIFICATION APPROVAL REQUEST APPLICATION FORM

MOD640, Rev. 0

1. NAME AND ADDRESS OF APPLICANT:

AERO Design Ltd.
2013 39th Avenue N.E.
Calgary, AB, T2E 6R7

2. IDENTIFICATION OF PRODUCT

MAKE:	MODEL:
Robinson	R44

ALL CORRESPONDANCE TO:
AERO Design Ltd.
2013 39th Ave N.E.
Calgary, AB T2E 6R7

SERIAL No.:

REGISTRATION:

3. REQUEST FOR:

A. SUPPLEMENTAL TYPE CERTIFICATE (STC)	☐	
B. STC/STA REVISION	☐	STC/STA No.
C. LIMITED SUPPLEMENTAL TYPE CERTIFICATE (LSTC)	☐	
D. LIMITED STC/STA REVISION	☐	LSTC/LSTA No.
E. F.A.A. SUPPLEMENTAL TYPE CERTIFICATE	☐	
F. F.A.A. STC REVISION	☐	STC No.
G. FAMILIARIZATION OF F.A.A. STC	☐	STC No.
H. REPAIR DESIGN APPROVAL (RDC)	☐	
I. PARTS DESIGN APPROVAL (PDA)	☐	

4. TITLE OF MODIFICATION OR REPAIR:

Bear Paws Installation

5. BRIEF DESCRIPTION OF MODIFICATION OR REPAIR:

Installation of bear paws on the skid tubes fabricated from aluminum sheet.

6. APPLICABLE TYPE APPROVAL (TA) OR TYPE CERTIFICATE (TC) DOCUMENTS:

A. TA NO. H-97 B. TC No. _____ C. OTHER _____

7. PROPOSED BASIS OF APPROVAL:

A. SAME AS TA ☒ B. SAME AS TC ☐ C. OTHER ☐ (Please specify) _____

8. DOCUMENTATION CHECKLIST

	REQUIRED		FOR DOT USE ONLY		
			RECEIVED		
	YES	NO	YES	NO	DATE
COMPLIANCE PROGRAM	X				
MASTER DRAWING LIST	X				
FLIGHT MANUAL SUPPLEMENT		X			
MAINTENANCE MANUAL SUPPLEMENT		X			
INSTRUCTIONS FOR CONTINUING AIRWORTHINESS		X			
ENGINEERING REPORTS	X				
DESIGN DRAWINGS		X			
MANUFACTURE DRAWINGS & INSTALLATION INSTRUCTIONS	X				
ELECTRICAL LOAD ANALYSIS		X			
DRAFT STC, LSTC OR RDA		X			
WEIGHT AND MOMENT CHANGE	X				
FLIGHT TEST DATA					
OTHER (Specify)					

9. APPLICANT'S REMARKS:

10. In addition to the payment of Aircraft Certification approval fees as prescribed in Canadian Aviation Regulations (CAR) Section 104, I agree to reimburse Transport Canada incremental expenses as in Aviation Regulation Directive No. 3, or equivalent, as applicable. For further details governing cost recovery, refer to AMA 513/4.

E & B Helicopters Ltd.

PER: _____ Consultant 04 February, 2005

SIGNATURE OF APPLICANTS — TITLE — DATE

11.

_____ _____

SIGNATURE OF REGIONAL ENGINEER — DATE

AERO Design Ltd.

FLIGHT TEST PLAN

ER 640.02

Installation of Bear Paws

Robinson R-44

Revision 0
18 March 2005

AERO Design Ltd.
Engineering Consultants

2013 – 39th Avenue N.E., Calgary, Alberta T2E 6R7
Phone: (403) 250-8027
Fax: (403) 250-8333
E-Mail: aerodesign@telusplanet.net

TABLE OF CONTENTS

1.0 INTRODUCTION

Bear Paws are installed on the Robinson R44 series to improve stability when landing on soft terrain, such as snow.

2.0 REFERENCE

Rotorcraft Flight Manual, Robinson R44-II

Aero Design Ltd. Installation Drawing 64001, Bear Paws.

3.0 BASIS OF CERTIFICATION

R44 and R44-II

Type Certificate H11NM granted December 10, 1992.

FAR 27, including Amendment 27-24.

This flight test programme will demonstrate that the installation of Bear Paws complies with the flight requirements of the original basis of certification.

4.0 FLIGHT TEST PREPARATION

4.1 General

The flight crew should review and be familiar with the regulatory requirements of FAR 27 Subpart B - Flight prior to conducting flight tests. These requirements are included as Appendix A.

The flight crew should examine and be familiar with the modification installed including a review of the proposed Flight Manual Supplement.

The relative cyclic stick position in the various flight conditions is to be determined by attaching light retracting type tape measures between the cyclic stick and the airframe in both the longitudinal and lateral directions.

Test points must be flown accurately allowing the aircraft to stabilize before data is recorded.

Each limiting condition should be approached with caution, using an incremental build-up approach.

The flight crew should always be attentive to unusual noises, vibrations, control characteristics, attitudes and instrument indications.

4.2 Configuration

Baseline flight

The helicopter shall be in the same configuration as flown for the modification flight test except that the external portions of the modification shall be removed. The helicopter shall be ballasted to obtain the same gross weight and centre of gravity as flown for the modification flight test.

Modification flight test

Those components of the modification which alter the external profile of the aircraft shall be installed in accordance with the applicable installation drawings.

Any other unusual or particularly large external modifications should be removed if practical and all external modifications installed during flight testing should be noted in the flight test report.

The aircraft is to be ballasted to its maximum gross weight.

4.3 Flight Authority

The Certificate of Airworthiness may not be valid after the modification has been installed. Flight Authority in the form of a flight permit may be required.

Flight authority to exceed the published V_{ne} of the helicopter is required. When the V_{ne} for the modification as provided in the proposed Flight Manual Supplement does not restrict the maximum speed to less that 90% of the basic helicopter V_{ne} then, the flight permit should specifically state that a higher V_{ne} is authorized.

4.4 Definitions

Stability: It shall be possible to fly the helicopter in normal maneuvers for a continuous period of time appropriate to the operational use of the particular type of helicopter without the pilot experiencing undue fatigue or strain.

Static longitudinal stability: The characteristics of the longitudinal cyclic control shall be such that, with constant throttle and collective pitch settings, a rearward displacement of the longitudinal control shall be necessary to obtain and maintain speeds below the specified trim speed, and a forward displacement shall be necessary to obtain and maintain speeds above the specified trim speed.

Adequate control margins: There is adequate control and stick movement available from the position at the trim speed to the control stops or other obstructions to stick movement to safely control the helicopter.

5.0 FLIGHT TEST PROCEDURE

5.1 Flight Characteristics

Controllability Stability Flutter and Vibration

FAR 27.141, 27.143, 27.171 and 27.629

Low Speed

FAR 27.141(b), 27.143(a), 27.143(c), 27.171, 27.175(d) and 27.629

Hover in a fixed position at a skid height of approximately 5 – 15 ft above the ground

Translate in both sideward directions and in a rearward direction into the prevailing wind until airspeed estimated to be 17 knots (20 mph) has been reached.

Record:
- adequate control margins
- Relative lateral and longitudinal stick position (tape measurement)
- Observe and record any indications of flutter or vibrations

Climb

FAR 27.141(b), 27.143(a), 27.171, 27.175(a) and 27.629

At the recommended climb speed, V_y, from the Basic Flight Manual increase power slowly until reaching Maximum Continuous Power

Make a 30° bank turn to the left and to the right

Record:
- adequate control margins
- Relative lateral and longitudinal stick position
- Positive static longitudinal stability
- Observe and record any indications of flutter or vibrations

Level Flight

CAR 27.141(b), 27.143(a), 27.171, 27.175(b), 27.177, and 27.629

Transition from hover to forward flight increasing the speed incrementally in 10 mph steps until Maximum Continuous Power is being applied, or V_{ne} from the proposed Flight Manual Supplement is reached, whichever is less.

At each speed increment make a 30° bank turn to the left and the right

Record:
- adequate control margins
- Relative lateral and longitudinal stick position
- Positive static longitudinal stability
- Observe and record any indications of flutter or vibrations

In the basic Flight Manual, V_{ne} is 130 KIAS up to 2200 pounds, and 120 KIAS above.

At Maximum Continuous Power, V_h, or V_{ne} from the proposed Flight Manual Supplement, whichever is less

CAR 27.143(a)

Record:
- stable airspeed, V_h
- record if V_{ne} was reached prior to applying MCP

Continue to accelerate the aircraft in 10 mph increments by maintaining Maximum Continuous Power and descending as necessary V_{ne} is reached.

FAR 27.143(b) and 27.629

At each speed increment make a 30° bank turn to the left and to the right

At V_{ne} ensure there are adequate control margins and adequate pitch control

Record:
- adequate control margins
- Relative lateral and longitudinal stick position
- Positive static longitudinal stability
- Observe and record any indications of flutter or vibrations

For the flight test with modification installed only

Compare the longitudinal stick position (as measured with the measuring tape attached to the cyclic stick) for modification installed flight test to the position obtained in the baseline flight at V_{ne} this point. If the longitudinal stick position is further forward at V_{ne} with the modification installed (basic helicopter V_{ne} or proposed Flight Manual Supplement V_{ne}, whichever is less) than was determined during the baseline flight at V_{ne} then it may be necessary to further limit the V_{ne} with the modification installed due to mast bending considerations.

Applying power as required, and further descending the helicopter if necessary, cautiously accelerate the helicopter until the longitudinal cyclic stick position is in the same location as was determined in the baseline flight at V_{ne} from the basic helicopter Flight Manual.

Record:
- speed at which, for the modification installed, longitudinal cyclic stick position is in the same location as was determined in the baseline flight at the V_{ne}.

Autorotation

FAR 27.141(b), 27.143(a)(v), 27.143(d), 27.175(c) and 27.629

At each of V_y, normal cruise speed and V_h, from level flight (if possible) simulate a sudden engine failure by rapidly retarding the throttle to the idle position. The collective stick must be kept in the power-on position for at least one (1) second after the throttle is retarded before any response is made.

Record:
- assess that autorotation entry characteristics not changed from basic aircraft
- observe and report any unusually rapid rotor speed decay.
- For entry speed at V_h, adequate pitch and roll control

During descent, vary forward speed between 50% $V_{min\ rate\ of\ descent}$ and $V_{ne\ autorotation}$, (100 KIAS) making gentle turns to the left and to the right.

Record:
- adequate control margins
- unusual pitch, roll or yaw rates
- observe and record any indications of flutter or vibrations

5.2 Performance

FAR 27.65(b)

If the external modification is of significant size and shape as to affect the climb performance of the helicopter the following procedure shall be included in the flight test.

On a compass heading at 90° to the local wind conditions, from level flight at the recommended climb speed, V_y, increase power to Maximum Continuous Power maintaining airspeed. When a steady rate of climb is established, note the altimeter reading and measure the time to climb through an altitude of 1000 ft.

Record:
- Starting altitude
- Time to climb through 1000 ft.

Repeat the above procedure on the reciprocal compass heading starting at the same altitude

Record:
- Starting altitude
- Time to climb through 1000 ft.

5.3 Flight at Demonstration Speed

FAR 27.629, 27.309 and 27.1505(a)

Caution: The rotorcraft should be maneuvered gently above V_{ne}

The aircraft should be accelerated slowly above V_{ne} to ensure the target airspeed is not passed.

Applying Maximum Continuous Power and descending the aircraft as required, cautiously accelerate the aircraft to 1.11 times V_{ne}

Make a 30° bank turn to the left and the right

Record:
- maximum airspeed attained
- observe and record any indications of flutter or vibrations

In the basic Flight Manual, V_{ne} is 130 KIAS below 2200 pounds, therefore V_d must not exceed 144 KIAS.

At weights above 2200 pounds, V_{ne} is 120 KIAS, hence V_d may not exceed 133 KIAS.

5.4 Other Observations

Effect of modification on normal and emergency procedures

Record: - Comment

Effect of modification on normal and emergency egress

Record: - Comment

Evaluation of modification Flight Manual Supplement

Record: - Comment

APPENDIX A

FLIGHT TEST REPORT

APPENDIX B

WEIGHT AND BALANCE CALCULATIONS

APPENDIX C

FAR 27 REQUIREMENTS

Sec. 27.65 – Climb: All engines operating.

(a) For rotorcraft other than helicopters--
(1) The steady rate of climb, at V_Y, must be determined--
(i) With maximum continuous power on each engine;
(ii) With the landing gear retracted; and
(iii) For the weights, altitudes, and temperatures for which certification is requested; and
(2) **[**The climb gradient, at the rate of climb determined in accordance with paragraph (a)(1) of this section, must be either--**]**
(i) At least 1:10 if the horizontal distance required to take off and climb over a 50-foot obstacle is determined for each weight, altitude, and temperature within the range for which certification is requested; or
(ii) **[**At least 1:6 under standard sea level conditions.**]**
(b) Each helicopter must meet the following requirements:
(1) V_Y must be determined--
(i) For standard sea level conditions;
(ii) At maximum weight; and
(iii) With maximum continuous power on each engine.
(2) **[**The steady rate of climb must be determined--
(i) At the climb speed selected by the applicant at or below V_{NE};
(ii) Within the range from sea level up to the maximum altitude for which certification is requested;
(iii) For the weights and temperatures that correspond to the altitude range set forth in paragraph (b)(2)(ii) of this section and for which certification is requested; and
(iv) With maximum continuous power on each engine.**]**

Sec. 27.141 – Flight Characteristics: General.

The rotorcraft must--
[(a) Except as specifically required in the applicable section meet the flight characteristics requirements of this subpart--
(1) At the altitudes and temperatures expected in operation;**]**
(2) Under any critical loading condition within the range of weights and centers of gravity for which certification is requested;
(3) For power-on operations, under any condition of speed, power, and rotor r.p.m. for which certification is requested; and
(4) For power-off operations, under any condition of speed and rotor r.p.m. for which certification is requested that is attainable with the controls rigged in accordance with the approved rigging instructions and tolerances;
(b) Be able to maintain any required flight condition and make a smooth transition from any flight condition to any other flight condition without exceptional piloting skill, alertness, or strength, and without danger of exceeding the limit load factor under any operating condition probable for the type, including--
(1) Sudden failure of one engine, for multiengine rotorcraft meeting Transport Category A engine isolation requirements of Part 29 of this chapter; and
(2) Sudden, complete power failure, for other rotorcraft; and
(3) Sudden, complete control system failures specified in Sec. 27.695 of this Part; and
(c) Have any additional characteristic required for night or instrument operation, if certification for those kinds of operation is requested. Requirements for helicopter instrument flight are contained in Appendix B of this Part.

Sec. 27.143 – Controllability and maneuverability.

(a) The rotorcraft must be safely controllable and maneuverable--
(1) During steady flight; and
(2) During any maneuver appropriate to the type, including--
(i) Takeoff;
(ii) Climb;
(iii) Level flight;
(iv) Turning flight;
(v) Glide;
(vi) Landing (power on and power off); and
(vii) Recovery to power-on flight from a balked autorotative approach.
(b) The margin of cyclic control must allow satisfactory roll and pitch control at V_{NE} with--
(1) Critical weight;
(2) Critical center of gravity;
(3) Critical rotor r.p.m.; and
(4) Power off (except for helicopters demonstrating compliance with paragraph (e) of this section) and power on.
(c) A wind velocity of not less than 17 knots must be established in which the rotorcraft can be operated without loss of control on or near the ground in any maneuver appropriate to the type (such as crosswind takeoffs, sideward flight, and rearward flight), with--
(1) Critical weight;
[(2) Critical center of gravity;
(3) Critical rotor r.p.m.; and
(4) Altitude, from standard sea level conditions to the maximum altitude capability of the rotorcraft or 7,000 feet, whichever is less.**]**
(d) The rotorcraft, after (1) failure of one engine in the case of multiengine rotorcraft that meet Transport Category A engine isolation requirements, or (2) complete engine failure in the case of other rotorcraft, must be controllable over the range of speeds and altitudes for which certification is requested when such power failure occurs with maximum continuous power and critical weight. No corrective action time delay for any condition following power failure may be less than--
(i) For the cruise condition, one second, or normal pilot reaction time (whichever is greater); and
(ii) For any other condition, normal pilot reaction time.
(e) For helicopters for which a V_{NE} (power-off) is established under Sec. 27.1505(c), compliance must be demonstrated with the following requirements with critical weight, critical center of gravity, and critical rotor r.p.m.:
(1) The helicopter must be safely slowed to V_{NE} (power-off), without exceptional pilot skill, after the last operating engine is made inoperative at power-on V_{NE}.
(2) At a speed of 1.1 V_{NE} (power-off), the margin of cyclic control must allow satisfactory roll and pitch control with power off.

Sec. 27.171 – Stability: General

The rotorcraft must be able to be flown, without undue pilot fatigue or strain, in any normal maneuver for a period of time as long as that expected in normal operation. At least three landings and takeoffs must be made during this demonstration.

Sec. 27.173 – Static longitudinal stability.

[(a) The longitudinal control must be designed so that a rearward movement of the control is necessary to obtain a speed less than the trim speed, and a forward movement of the control is necessary to obtain a speed more than the trim speed.
(b) With the throttle and collective pitch held constant during the maneuvers specified in Sec. 27.175(a) through (c), the slope of the control position versus speed curve must be positive throughout the full range of altitude for which certification is requested.
(c) During the maneuver specified in Sec. 27.175(d), the longitudinal control position versus speed curve may have a negative slope within the specified speed range if the negative motion is not greater than 10 percent of total control travel.]

Sec. 27.175 – Demonstration of static longitudinal stability.

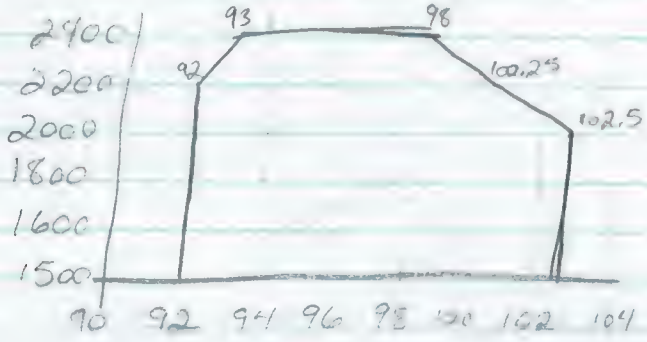
(a) *Climb.* Static longitudinal stability must be shown in the climb condition at speeds from 0.85 V_Y to 1.2 V_Y, with--
(1) Critical weight;
(2) Critical center of gravity;
(3) Maximum continuous power;
(4) The landing gear retracted; and
(5) The rotorcraft trimmed at V_Y.
(b) *Cruise.* Static longitudinal stability must be shown in the cruise condition at speeds from 0.7 V_H or 0.7 V_{NE}, whichever is less, to 1.1 V_H or 1.1 V_{NE}, whichever is less, with--
(1) Critical weight;
(2) Critical center of gravity;
(3) Power for level flight at 0.9 V_H or 0.9 V_{NE}, whichever is less;
(4) The landing gear retracted; and
(5) [The rotorcraft trimmed at 0.9 V_H or 0.9 V_{NE}, whichever is less.]
(c) *Autorotation.* Static longitudinal stability must be shown in autorotation at airspeeds from 0.5 times the speed for minimum rate of descent to V_{NE} or to 1.1 V_{NE} (power-off) if V_{NE} (power-off) is established under Sec. 27.1505(c), and with--
(1) Critical weight;
(2) Critical center of gravity;
(3) Power off;
(4) The landing gear--
(i) Retracted; and
(ii) Extended; and
(5) The rotorcraft trimmed at appropriate speeds found necessary by the Administrator to demonstrate stability throughout the prescribed speed range.
(d) *Hovering.* For helicopters, the longitudinal cyclic control must operate with the sense and direction of motion prescribed in Sec. 27.173 between the maximum approved rearward speed and a forward speed of 17 knots with--
(1) Critical weight;
(2) Critical center of gravity;
(3) Power required to maintain an approximate constant height in ground effect;
(4) The landing gear extended; and
(5) The helicopter trimmed for hovering.

Sec. 27.177 – Static directional stability.

[Static directional stability must be positive with throttle and collective controls held constant at the trim conditions specified in Sec. 27.175 (a) and (b). This must be shown by steadily increasing directional control deflection for sideslip angles up to $\pm 10°$ from trim. Sufficient cues must accompany sideslip to alert the pilot when approaching sideslip limits.]

ROBINSON R44 I II

V_{NE} @ GW < 2200 lb	130 KIAS	
@ GW > 2200 lb	120 KIAS	
@ AUTO ROTATION	100 KIAS	
@ P > M.C.P.	100 KIAS	
W/O DOORS	100 KIAS	
POWER	MCP = 205 / TO = 225	MCP 205 / 245
MAX G.W.	2400 lb	2500



FUEL MAIN. 30.6 GAL (187 LB) @ 106 IN
AUX. 18.3 GAL (112 LB) @ 102 IN

ALT. 9000 FT AGL (TO ALLOW 5 MIN TO LAND IN CASE OF FIRE

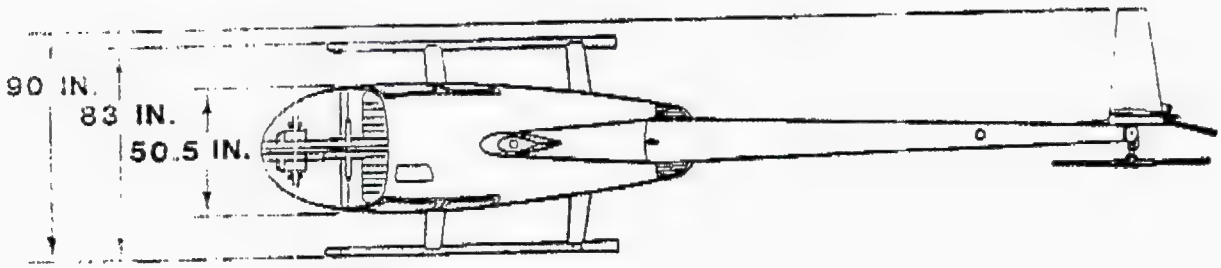
$\frac{9000 \text{ FT}}{5 \text{ MIN}}$ = 180 FT/MIN RATE OF DESCENT

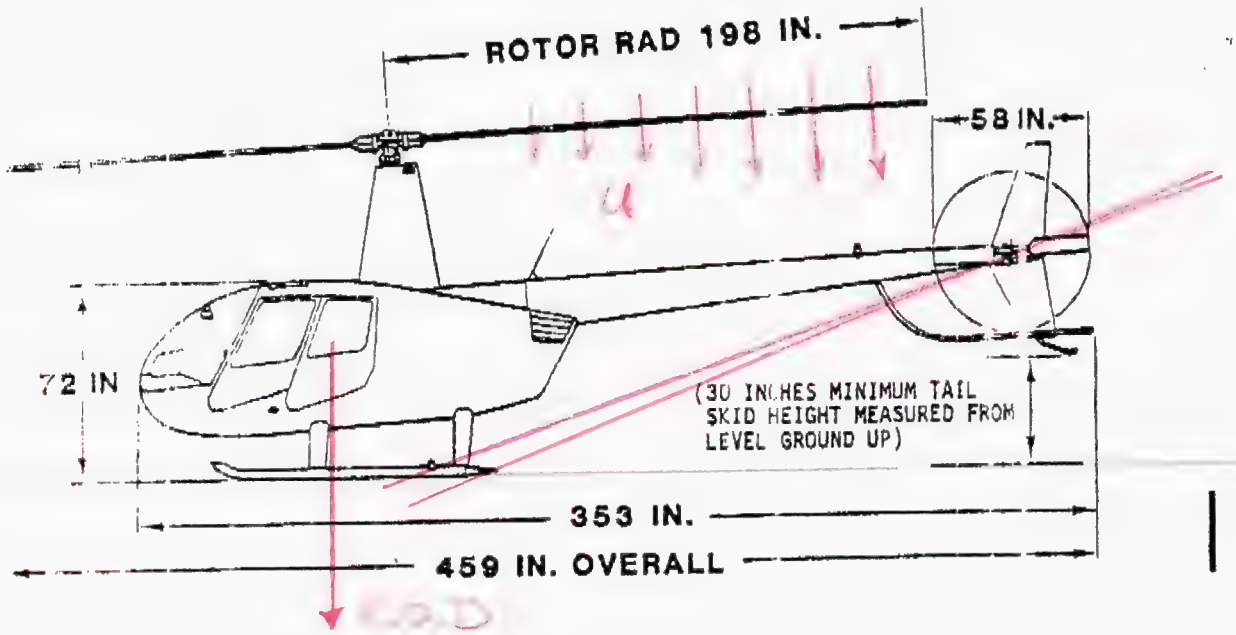
FAR 27-24

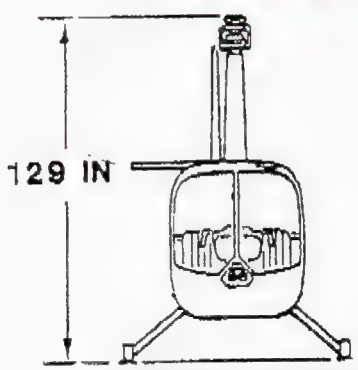
BAGGAGE LOCATION?

V_Y? $V_{MIN\ ROC}$?

1.005 EXTERNAL DIMENSIONS





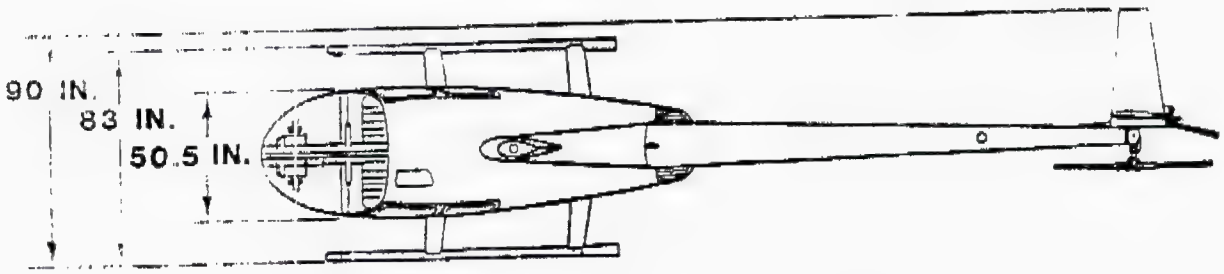


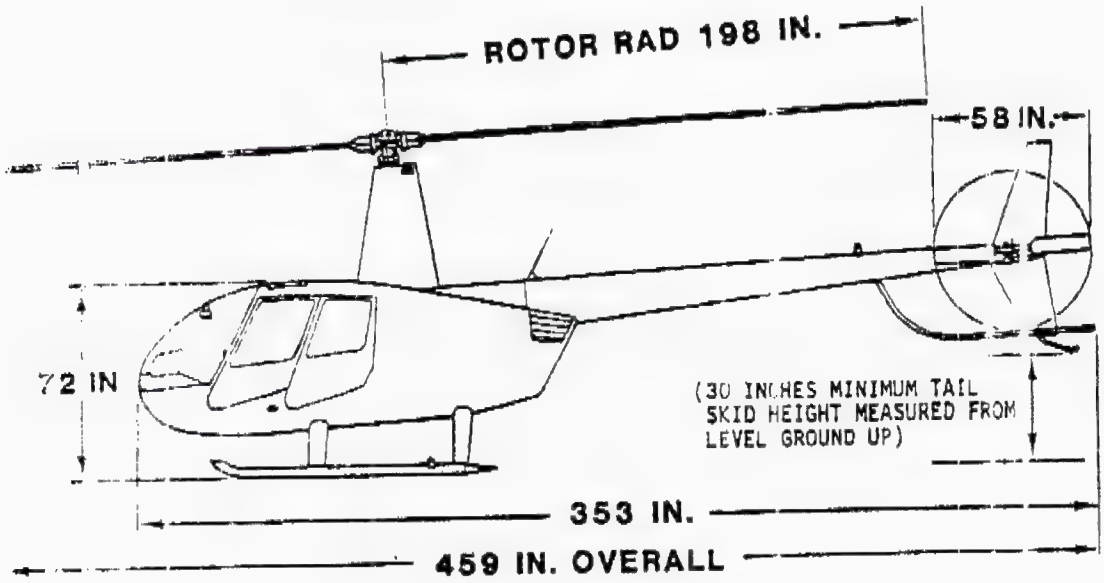
(129 IN. STANDARD LANDING GEAR, 130.5 IN. FLOAT OR HIGH (EXTENDED) LANDING GEAR)

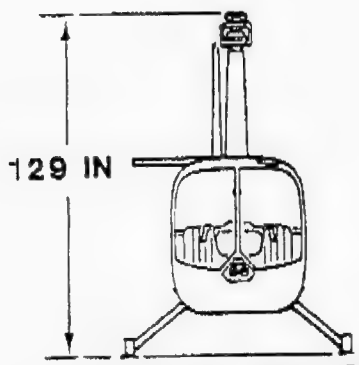
R44 Astro

EXTERNAL DIMENSIONS

1.006 EXTERNAL DIMENSIONS







(129 IN. STANDARD LANDING GEAR.
130.5 IN. FLOAT OR HIGH (EXTENDED) LANDING GEAR)

R44 Astro

EXTERNAL DIMENSIONS

Type Certificate Data Sheet

Number: H-97
Issue No.: 5
Approval Date: Refer Below
Issue Date: July 4, 2003

This Data Sheet which is part of Type Certificate No. H-97 prescribes the conditions and limitations under which the product(s) for which the Type Certificate was granted meet(s) the standards of airworthiness required by the Canadian Aviation Regulations.

Type Certificate Holder:
Robinson Helicopter Company
2901 Airport Drive
Torrance, California 90505

Models	
R44	R44 II

1. Model R44	(Normal Category)	Approved July 27, 1993
2. Model R44 II	(Normal Category)	Approved May 30, 2003

Except as otherwise noted below, the conditions and limitations prescribed by this data sheet are those specified in the FAA Type Certificate Data Sheet H11NM Revision 3, dated October 10, 2002. Subsequent revisions to the FAA Type Certificate Data Sheet are not applicable to Canadian registered aircraft. In addition the following requirements apply:

Basis of Certification

1) As per H11NM plus Canadian Airworthiness Manual Chapter 527 change 527-2, dated 1 February, 1992 for the following paragraphs;

527.1301-1	Rotorcraft operations after Ground Cold Soak
527.1557(c)(3)	Miscellaneous Markings and Placards
527.1583(h)	Operating Limitations -Ambient Temperature

2) The noise requirements of ICAO Annex 16, Volume 1, (Second Basis Edition dated 1988), Chapter 11.

Canada

Type Certificate Data Sheet

(Continuation Sheet)

Number: H-97 Issue 5

Approved Publications

R44

Rotorcraft Flight Manual as specified in H11NM in addition to FAA Approved R44 Pilot's Operating Handbook Canadian Supplement dated May 28, 2003 or later approved revision.

R44 II

Rotorcraft Flight Manual as specified in H11NM in addition to FAA Approved R44 II Pilot's Operating Handbook Canadian Supplement dated May 28, 2003 or later approved revision.

Import Requirements

The import documentation must include:

a) A United States Export Certificate of Airworthiness to Canada signed by a representative of the Federal Aviation Administration (FAA)

or

b) A Certificate of Airworthiness for Export signed by the Airworthiness Authority of a country with whom Canada has a Bilateral Airworthiness agreement.

In case a) or b) the C of A must contain the following statement:

"The aircraft identified by this Certificate has been examined and found to conform to the Canadian Department of Transport Type Certificate H-97"

or

c) Other procedures approved by the Minister of Transport.

Martin J. Eley
Director, Aircraft Certification
for Minister of Transport

Canada

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

H11NM
Revision 3
ROBINSON

R44
R44 II

October 10, 2002

TYPE CERTIFICATE DATA SHEET NO. H11NM

This data sheet, which is a part of Type Certificate No. H11NM, prescribes conditions and limitations under which the product for which the type certificate was issued meets the airworthiness requirements of the Federal Aviation Regulations.

Type Certificate Holder: Robinson Helicopter Company
2901 Airport Drive
Torrance, California 90505

I - Model R44 (Normal Category Rotorcraft), Approved December 10, 1992

Engine: One Lycoming O-540-F1B5, Type Certificate number E-295

Fuel: 100 minimum grade aviation gasoline
100/130 minimum grade aviation gasoline

Engine Limits:
Maximum continuous: 205 hp at 2718 rpm (102%)
Takeoff (5 minute): 225 hp at 2718 rpm (102%)

See Rotorcraft Flight Manual (RTR 461) for maximum manifold pressure corresponding to horsepower rating.

Rotor Speed Limits:

Power Off (Rotor Tach)	Power On (Rotor Tach)
Maximum: 432 rpm (108%)	Maximum: 408 rpm (102%)
Minimum: 360 rpm (90%)	Minimum: 396 rpm (99%)

Airspeed Limits: V_{NE} (never exceed speed) at sea level is 130 KIAS (120 KIAS with fixed floats) for takeoff gross weights of 2200 lbs. or less. V_{NE} at sea level is 120 KIAS (110 KIAS with fixed floats) for takeoff gross weights over 2200 lbs.

Power Off (Autorotation) V_{NE} at sea level is 100 KIAS.

For reduction of V_{NE} with altitude and temperature, see R44 Rotorcraft Flight Manual (RTR 461).

Airspeed limit at power settings above Maximum Continuous Power is 100 KIAS.

Airspeed limit with inflated pop-out floats is 80 KIAS.

Airspeed limit for any combination of Doors Off is 100 KIAS.

Center of Gravity (C.G.) Range

Longitudinal C.G. Range

Gross Weight (lbs.)	Forward (in.)	Aft (in.)
1550	92.0	102.5
2000	92.0	102.5
2200	92.0	100.25
2400	93.0	98.0

Lateral C.G. Range

Long. C. G. (in.)	Left (in.)	Right (in.)
92.0	-3.0	+3.0
100.0	-3.0	+3.0
102.5	-1.5	+1.5

Note: Straight line variation between points shown

Empty Weight C.G. Range

Calculated C.G. with 150 lb. pilot and full fuel must be STA 102.5 or forward.

Maximum Weight

2400 lb.

Minimum Crew

1 pilot in forward right seat.

Number of Seats

4 (3 for Police Version)
Seat Locations: Pilot and Forward Passenger at STA 49.5
Aft Passengers at STA 79.5

Maximum Baggage

50 pounds of baggage and installed equipment in any baggage compartment. For any seat location, the maximum combined weight of the seat load, baggage, and installed equipment is 300 lbs.

Fuel Capacity

Tank	Capacity (gal.)	Usable (gal.)	Location (STA)
Main	31.6	30.6	106.0
Auxiliary	18.5	18.3	102.0

Oil Capacity

Component	Capacity (qt.)	Location (STA)
Engine	9	110.0
Main Rotor Transmission	2	100.0
Tail Rotor Transmission	0.11	327.0
Hydraulic Reservoir (if installed)	0.65	117.0

Maximum Operation Altitude

Density Altitude Limit 14,000 ft.
Maximum altitude above ground level is 9000 ft. to allow landing within 5 minutes in case of fire.

Manufacturer's Serial Numbers

0002, 0004 through 9999

Certification Basis

14 CFR Part 27, dated February 1, 1965, including Amendments 27-1 through 27-24, Exemption No. 5473 dated July 2, 1992, to §27.955(a)(7) and 27.1305(q), and Exemption No. 6692 dated October 17, 1997 to §27.695.

14 CFR Part 36 Amendment 36-20.

Equipment

The basic required equipment as prescribed in the applicable airworthiness regulations (see Certification Basis) must be installed in the aircraft for certification. In addition, the following FAA-approved Rotorcraft Flight Manual is required:

R44 Rotorcraft Flight Manual (RTR 461) dated December 10, 1992, or later revision (See NOTES 4, 5, & 6).

II. Model R44 II (Normal Category Rotorcraft), Approved October 10, 2002

The R44 II helicopter changes to a fuel injected engine with a 245 hp takeoff rating and a maximum weight of 2500 lb. Main and tail rotor blades are redesigned.

Engine

One Lycoming IO-540-AE1A5, Type Certificate number 1E4

Fuel

100 minimum grade aviation gasoline
100/130 minimum grade aviation gasoline

Engine Limits

Maximum continuous: 205 hp at 2718 rpm (102%)
Takeoff (5 minute): 245 hp at 2718 rpm (102%)

See R44 II Rotorcraft Flight Manual (RTR 462), dated October 3, 2002 or later FAA approved revision, for maximum manifold pressure corresponding to horsepower rating.

Rotor Speed Limits

Power Off (Rotor Tach)	Power On (Rotor Tach)
Maximum: 432 rpm (108%)	Maximum: 408 rpm (102%)
Minimum: 360 rpm (90%)	Minimum: 404 rpm (101%)

Airspeed Limits

V_{NE} (never exceed speed) at sea level is 130 KIAS (120 KIAS with fixed floats) for takeoff gross weights of 2200 lbs. or less. V_{NE} at sea level is 120 KIAS (110 KIAS with fixed floats) for takeoff gross weights over 2200 lbs.

Power Off (Autorotation) V_{NE} at sea level is 100 KIAS.

For reduction of V_{NE} with altitude and temperature, see R44 II Rotorcraft Flight Manual (RTR 462) dated October 3, 2002, or later FAA approved revision.

Airspeed limit at power settings above Maximum Continuous Power is 100 KIAS.

Airspeed limit with inflated pop-out floats is 80 KIAS.

Airspeed limit for any combination of Doors Off is 100 KIAS.

Center of Gravity (C.G.) Range

Longitudinal C.G. Range			Lateral C.G. Range		
Gross Weight (lbs.)	Forward (in.)	Aft (in.)	Long. C. G. (in.)	Left (in.)	Right (in.)
1600	92.0	102.5	92.0	-3.0	+3.0
2100	92.0	102.5	100.0	-3.0	+3.0
2300	92.0	100.25	102.5	-1.5	+1.5
2500	93.0	98.0			

Note: Straight line variation between points shown

Empty Weight C.G. Range

Calculated C.G. with 150 lb. pilot and full fuel must be STA 102.5 or forward.

Maximum Weight

2500 lb.
2400 lb. for intentional water landings with fixed or pop-out floats.

Minimum Crew

1 pilot in forward right seat.

Number of Seats

4 (3 for Police Version)
Seat Locations: Pilot and Forward Passenger at STA 49.5
Aft Passengers at STA 79.5

Maximum Baggage

50 pounds of baggage and installed equipment in any baggage compartment. For any seat location, the maximum combined weight of the seat load, baggage, and installed equipment is 300 lbs.

Fuel Capacity

Tank	Capacity (gal.)	Usable (gal.)	Location (STA)
Main	31.6	30.6	106.0
Auxiliary	18.5	18.3	102.0

Oil Capacity

Component	Capacity (qt.)	Location (STA)
Engine	9	110.0
Main Rotor Transmission	2	100.0
Tail Rotor Transmission	0.11	327.0
Hydraulic Reservoir (if installed)	0.65	117.0

Maximum Operation Altitude

Density Altitude Limit - 14,000 ft.
Maximum altitude above ground level is 9000 ft. to allow landing within 5 minutes in case of fire.

Manufacturer's Serial Numbers

1140, 10001 and subsequent

Certification Basis

14 CFR Part 27, dated February 1, 1965, including Amendments 27-1 through 7-24, and Exemption No. 6692 dated October 17, 1997 to §27.695.

14 CFR Part Amendment 36-24.

Equipment

The basic required equipment as prescribed in the applicable airworthiness regulations (see Certification Basis) must be installed in the aircraft for certification. In addition, the following FAA-approved Rotorcraft Flight Manual is required:

R44 II Rotorcraft Flight Manual (RTR 462) dated October 3, 2002, or later revision (See NOTES 7 & 8).

DATA PERTINENT TO ALL MODELS

Datum	100 in. forward of main rotor centerline.
Leveling Means	Refer to the R44 Maintenance Manual and Instructions for Continued Airworthiness (RTR 460).
Rotor Blade and Control Movements	Main Rotor blade angles at 75% radius:

Collective Pitch: 12.5° ±1.0° total travel

Note: Collective low pitch to be established in accordance with the Maintenance Manual and Instructions for Continued Airworthiness (RTR 460) procedures to obtain proper autorotation RPM.

Cyclic Pitch:	Forward	13.50° to 14.25°
	Aft	13.50° to 14.25°
	Left	7.5° to 8.5°
	Right	6.0° to 7.0°

Tail Rotor blade angles at 75% radius:

Collective Pitch:	Thrust to left	15.5° to 16.5°
	Thrust to right	18.5° to 19.0°

Production Basis	Production Certificate No. 424WE dated February 11, 1993.

NOTES

NOTE 1. A current weight and balance report, including a list of equipment included in the certificated empty weight, and loading instructions when necessary, must be provided for each aircraft at the time of original airworthiness certification and at all times thereafter, except in the case of operators having an approved weight control system.

NOTE 2. The following placard must be installed in clear view of the pilot:

"THIS ROTORCRAFT APPROVED FOR DAY AND NIGHT VFR OPERATIONS"

For additional placards, see the Rotorcraft Flight Manual. All placards required in the FAA-approved Rotorcraft Flight Manual must be installed in the appropriate locations.

NOTE 3. Information essential to the proper maintenance of the helicopter, including retirement time of critical components, is contained in the Robinson R44 Maintenance Manual and Instructions For Continued Airworthiness (RTR 460). Retirement times are listed in the FAA-approved "AIRWORTHINESS LIMITATIONS" section. The values of retirement or service life and inspection intervals cannot be changed without FAA Engineering approval.

NOTE 4. R44 Rotorcraft Flight Manual Supplement 5 dated July 17, 1996, or later FAA-approved revision is required when fixed float landing gear is installed.

NOTE 5. R44 Rotorcraft Flight Manual Supplement 10 dated June 10, 1999, or later FAA-approved revision is required when emergency (pop-out) floats are installed.

NOTE 6. R44 Rotorcraft Flight Manual with FAA-approved revisions through November 5, 1999, or later FAA-approved revision is required when hydraulically-boosted main rotor flight controls are installed.

NOTE 7. R44 II Rotorcraft Flight Manual Fixed Floats Supplement dated October 3, 2002, or later FAA-approved revision is required when fixed-float landing gear is installed.

NOTE 8. R44 II Rotorcraft Flight Manual Pop-Out Floats Supplement dated October 3, 2002, or later FAA-approved revision is required when pop-out floats are installed.

.....END.....

Department of Transportation
Federal Aviation Administration

Memorandum

SAP 176
3/8/85 WDL AFW

Subject: Applicable Requirements for Helicopter Landing Gear "Bear Paw" Installations

Date: FEB 21 1985

From: John J. Shapley
Manager, Helicopter Policy and Procedures

Reply to Attn of: Staff, ASW-110

To: ANE-170

In response to your letter dated December 19, 1984, requesting guidance for approval of auxiliary skid pads such as "bear paws," we hereby provide the following comments:

I. Structural Considerations.

Auxiliary skid pads, such as "Bear Paws," etc., are considered to be secondary structure and need not be designed to the full landing gear loads of subpart C of FAR Parts 27 or 29. However, even as secondary structure, auxiliary skid pads should be evaluated for reliability, durability, and possible hazards to the aircraft in accordance with §§ 27/29.601, 27/29.603, and 27/29.605. Also the general strength requirements of § 27/29.301 through § 27/29.307 should be met.

The following procedures are considered to be conservative and adequate to show compliance of auxiliary skid pad installations in accordance with the previous policy statement.

1. Static Strength:

(a) Ground Loads

(1) Use 1g (limit) static load at maximum gross weight and critical center-of-gravity (c.g.) of the helicopter with respect to pad loads.

(2) Assume equal load distribution between pads.

(3) For flexible, non-metallic pads, assume triangular load distribution on each pad in the Y-Z plane with the peak load at the skid centerline.

(4) For rigid pads, assume rectangular load distribution on each pad in the Y-Z plane.

3177

(b) All ... ads ← AIR LOADS.

(1) Use force coefficient, Cn .55. 0.55

(2) Use Vne for calculating dynamic pressure, q.

(c) Substantiate by test and/or analysis.

2. Dynamic Loads

FLIGHT

It should be verified that throughout the speed range from hover to Vne a resonant condition does not exist for the pads or the pad and skid landing gear combination. This should be accomplished by flight test using qualitative and/or quantitative measurements. Visual or auditory observations may be used to qualitatively verify that no resonance condition exists, or quantitative measurements using accelerometers may be obtained for verification.

3. Fatigue Substantiation of Skid Pads

Adequate fatigue substantiation can be provided by showing that the ground loads of Item 1 result in stresses which are below the endurance limit for the pad material and that the dynamic loads are low in accordance with Item 2 above.

4. Fatigue Substantiation of Original Landing Gear and Airframe (§ 27/29.971).

Verify by the flight tests of Item 2 above that no new airframe vibratory loads are introduced by the skid pads installation. If visual or auditory observations indicate significant new airframe vibratory loads may exist, instrumentation may be required to obtain quantitative vibratory data.

II. Flight Considerations

1. Performance

Unless the skid pads are very large in area, they should not have a significant effect on required helicopter performance (i.e., hover, takeoff, climb and landing). Thus performance measurements would not normally be required.

2. Flight Characteristics

Flight characteristics should be evaluated to verify that addition of the skid pads has not adversely affected controllability, manueverability, or stability (§§ 27/29.143 - 27/29.175).

(a) Controllability and Manueverability

A qualitative flight test evaluation should be conducted to compare the flight characteristics of the basic rotorcraft to the characteristics after the pad installation throughout the speed range from hover to Vne. If significant differences with the skid pads installed are noted by the test pilot, instrumentation should be installed to quantitatively verify that adequate control margins exist throughout the flight envelope.

(b) Stability

(1) Static

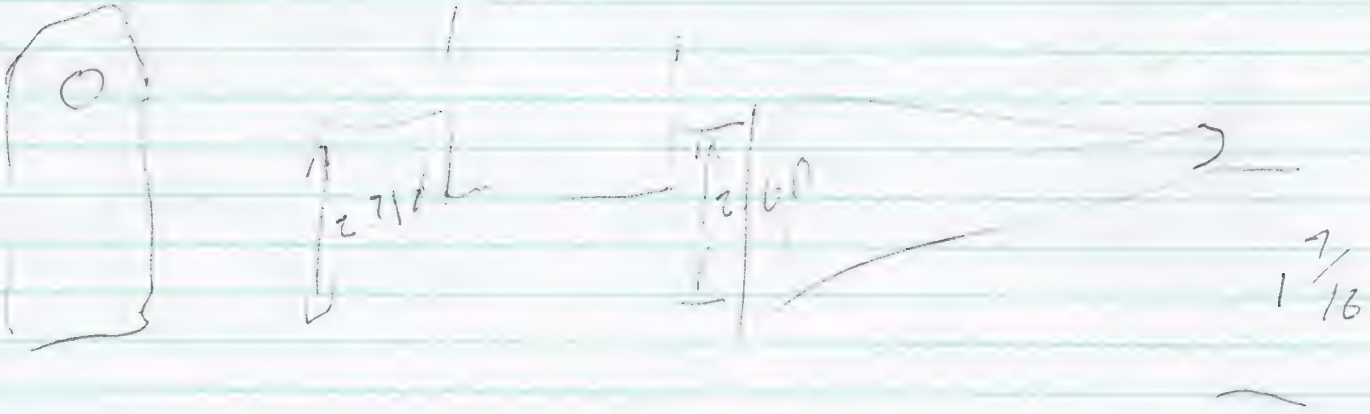
Quantitative static longitudinal stability should be obtained using a before and after comparison to verify that static stability has not been significantly affected by installation of the skid pads. The instrumentation required to conduct this test can be very simple since absolute control position is not required but only relative position with and without the pads. (A tape measurement of the distance between the cyclic control and a point on the instrument panel for example may be sufficient.) However, if significant differences are shown to exist, accurate instrumentation should be used to verify compliance with §§ 27/29.173 and 27/29.175.

(2) Dynamic

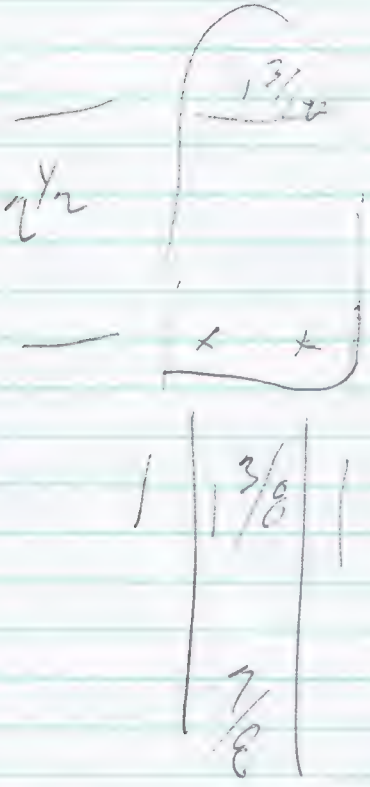
For helicopters certified for instrument flight, an assessment of the effect of skid pads on the dynamic stability should be made. For rotorcraft with required stability augmentation systems for IFR flight, the addition of skid pads should have little or no effect on the aircraft stability. The qualitative evaluation of Item 2(a) above will usually suffice to verify that dynamic stability characteristics have not been affected.

For rotorcraft which are IFR certified without stability augmentation systems results of the qualitative evaluation of step 2(a) and the quantitative evaluation of step 2(b)(1) above should be evaluated to determine if quantitative dynamic stability measurements are necessary. Generally if the test pilot finds no significant controllability differences and the static stability has not been affected, dynamic stability will not be affected. If a significant change in static stability is measured, dynamic stability should be closely evaluated if IFR certification of the skid pad configuration is desired.

#



13 1/2



2.71

2.6

11 1/2

1/8

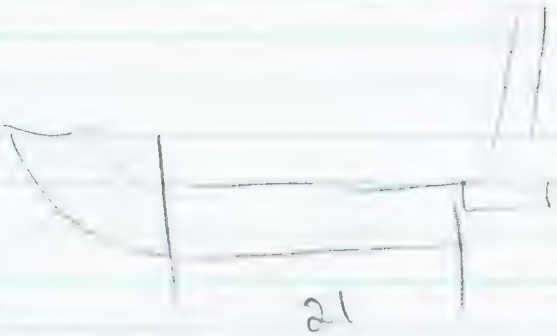
2 1/4

7 1/8

3 1/16

1 5/8

1 3/8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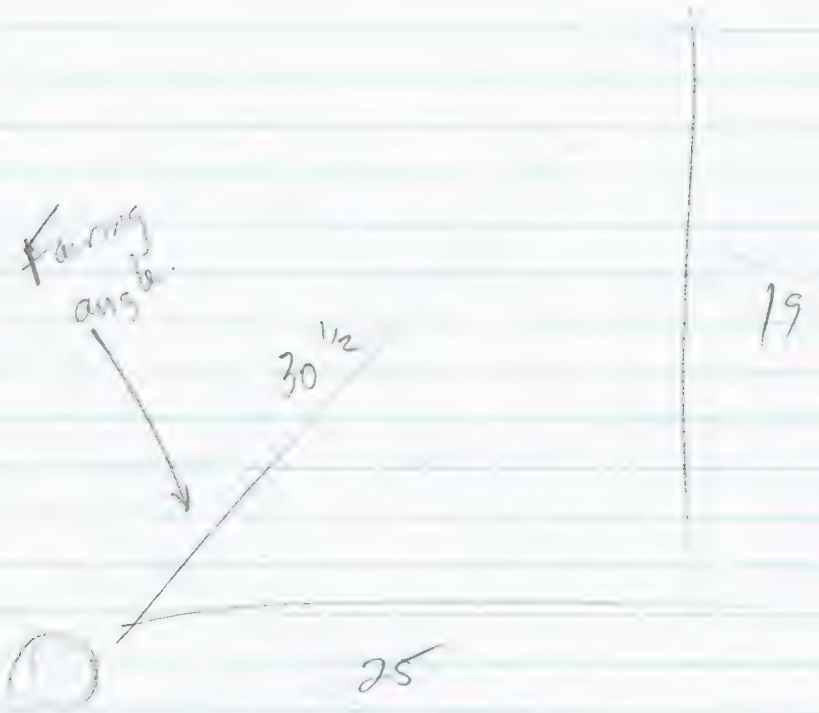

Facing angle
30 1/2
19
25

E & B HELICOPTERS LTD/ CUSTOMER SALES-SHIPPING SHEET

DATE: Jan 27/05

SHIPPING TO: Aero Design

ADDRESS: _____

_____

PHONE #: _____

CONTACT PERSON: _____

SHIP VIA: _____

COLLECT	PREPAID

CUSTOMER		THEIR PO#	
REPAIR		OUR PO#	ACTION TO BE TAKEN:
RETURN			
OTHER			

Attn: Ted Bergoin

ITEMS:

(A) P/N: Bear Paws (1 set)
S/N:

(B) P/N:
S/N:

(C) P/N:
S/N:

(D) P/N:
S/N:

(E) P/N:
S/N:

Thanks

Ed.

Make Lounge
- Main Support more centred
- takes Load off front

$30 \times 6403\frac{1}{2}{,}00$ #

$4\frac{1}{2} \times 750$ *
3000 # LW

$S = \frac{Mc}{I}$

$35{,}000 = \frac{3000}{S}$

$S = 0.1$ MIN

$I = \frac{1}{12}\left(\frac{1}{8}\right)^3 \times 18$

$= .00293$

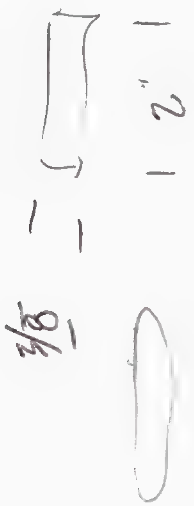
$F_b = 64{,}000$ psi.

CELL: 403 302 7966

TOM
SKYWINGS

2.5 ϕ

1.3.81



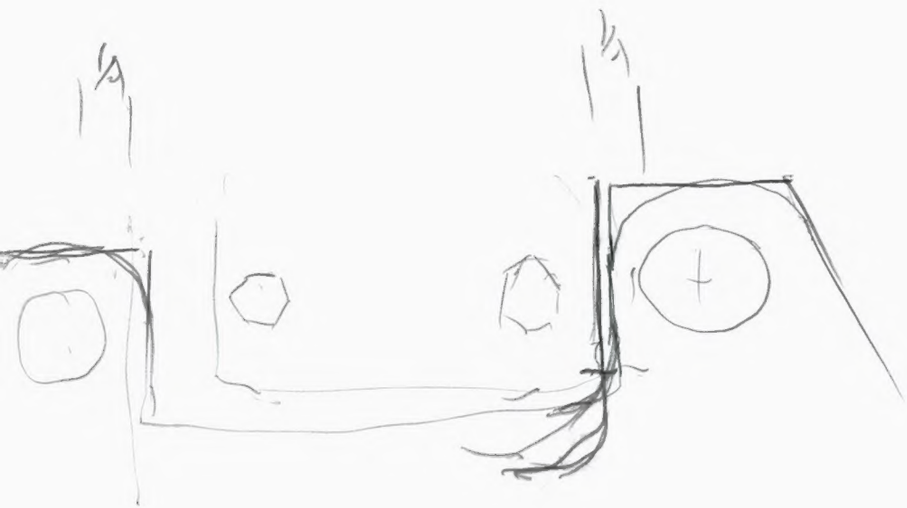
3/8

2"

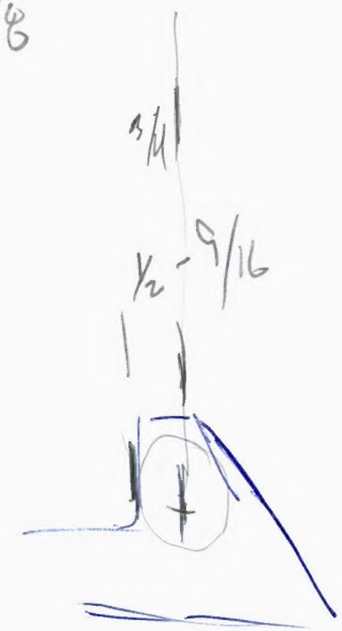
1500

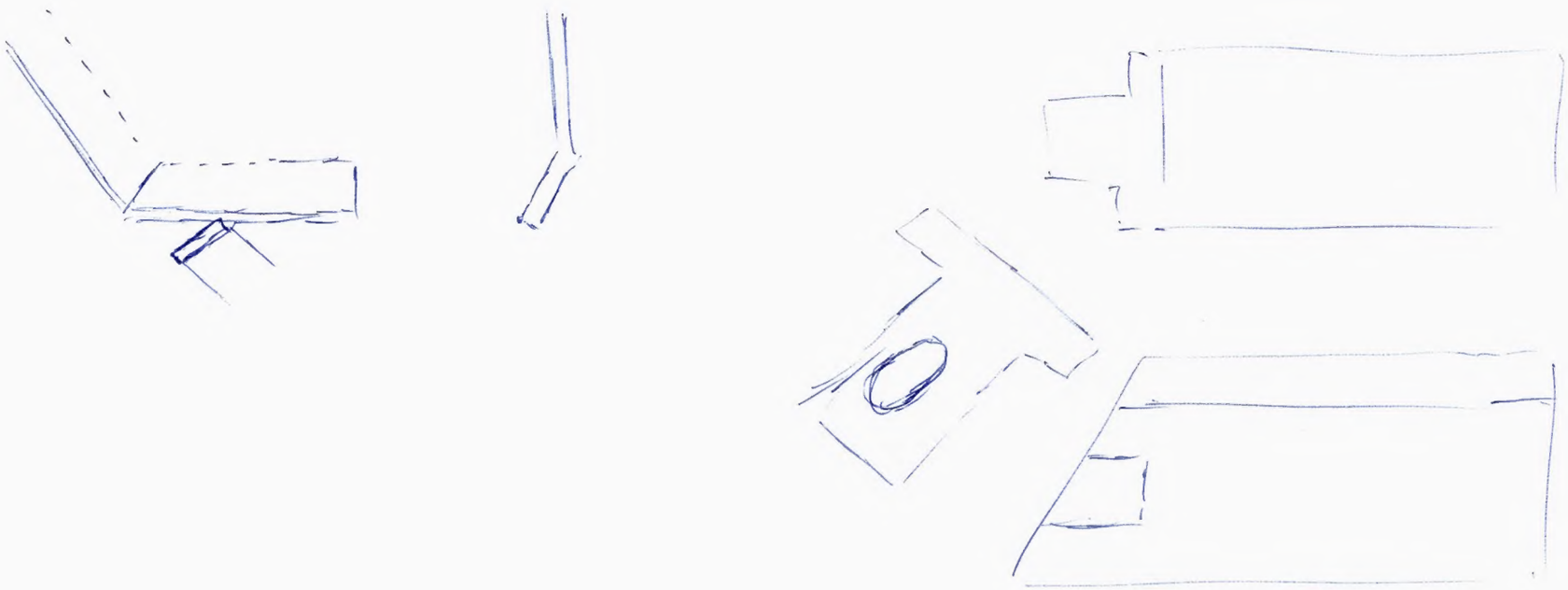
7/16 = Measurement OFF EXISTING PAD

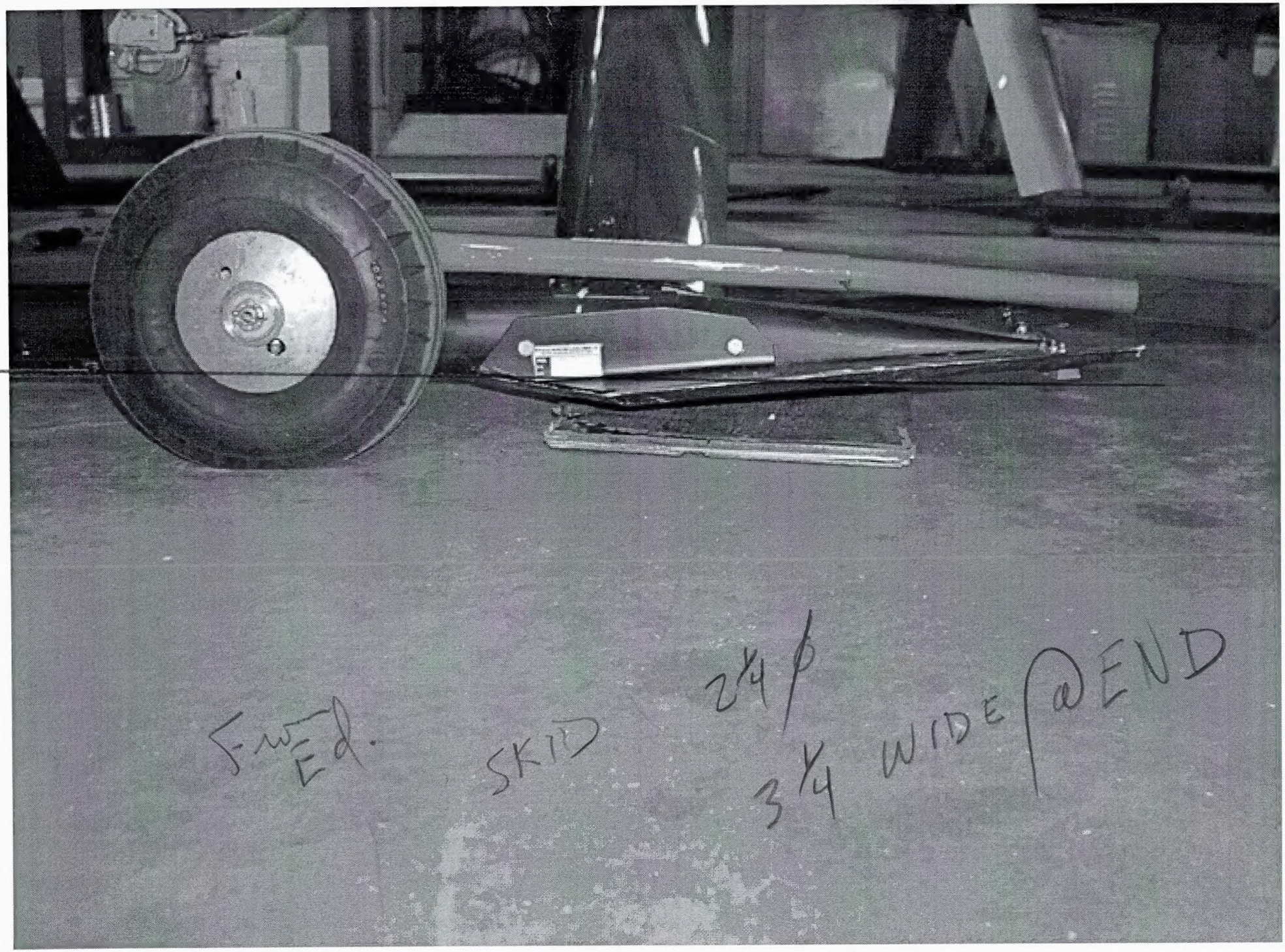
1/2



6 3/8






F-W-ED.
SKID
2¼ ϕ
3¼ WIDE @ END